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THE KANSAS UNIVERSITY SCIENCE BULLETIN.

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KANSAS APHIDIDÆ, WITH CATALOGUE OF NORTH AMERICAN ALPHIDIDÆ, AND WITH HOST-PLANT AND PLANT-HOST LIST, *Charles Emerson Sanborn.*

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KANSAS UNIVERSITY SCIENCE BULLETIN.

VOL. III, No. 1. JULY, 1904. WHOLE SERIES, VOL. XIII, No. 1.

KANSAS APHIDIDÆ.

WITH CATALOGUE OF NORTH AMERICAN APHIDIDÆ AND HOST-PLANT AND PLANT-HOST LIST.

With plates I to XXII.

BY CHARLES EMERSON SANBORN.

PREFACE.

IN securing material for ontogenetic study, I became impressed with the number of species of Aphididæ existing in Kansas. Accordingly, in the following pages appears the first part of the taxonomic discussion. It is the intention to complete this phase of the subject as soon as some other forms can be obtained.

The species discussed, whether new or old, have been described, in order to make them more easily recognized and understood by those interested but who have no access to literature. In doing this, not only have careful measurements been made with the eyepiece micrometer, but an illustration is presented with each specimen described, in order to emphasize characteristics not easily conveyed in words.

Yet however accurate some characteristics may be given they cannot always be depended upon. For instance, in coloration, variance of color depends not only upon age but also upon the season of the year. The same color may not prevail throughout the growth of an individual. The color present is not always constant in a species, because a change of temperature or a change of food-plant often gives a different tinge to the general color. Therefore, having these things to deal with, it has been very difficult to decide definitely in many cases the specific location of forms found.

In conclusion, the author thanks Prof. S. J. Hunter, the head of this department, under whose advice and guidance this work has been done. Expressions of appreciation are also due Miss Marguerite Wise and Miss Miriam Palmer, of this department, for assistance in the preparation of illustrations. Following their names are the figures drawn by each. Other figures contained were drawn by the author.

Miss Wise: 1 to 27, inclusive, 30, 34, 35, 36, 39, 48, 49, 50, 53, 62, 64, 66, 67, 68, 69, 70, 71, 72, 74, 75, 76, 83, 84, 85, 89, 93, 94, 95, 100.

Miss Palmer: 28, 37, 45, 56, 57, 59, 60, 61, 77, 78, 81, 86, 87, 88, 91, 96, 97, 98, 99, 101.

INTRODUCTION.

Plant-lice or aphids belong to the family Aphididæ and to the suborder Homoptera in the order Hemiptera. They are characterized as small, soft-bodied insects which receive their nourishment in the form of liquid taken into their bodies by means of setæ which lie in a jointed beak. The distal end of the latter is placed closely to the cellular tissue of the plant and used as a guide by means of which the four small, bristle-like setæ are extruded into the live tissues of the plant, from which the juicy nourishment is conveyed to the assimilative organs of the insect. They have six legs, and they may have a pair of compound eyes, three ocelli, two pairs of wings, a pair of honey-tubes, a beak, and a style, but these parts are not constant throughout the family.

The Head.

The first main division of the insect's body bears some very important organs of classification. It always bears a pair of antennæ, one on each side of the dorsocephalic angle of the head. Caudad of these are usually two large compound eyes, which at their caudal margins have a few facets extending beyond the rest. These are called occular tubercles. Between the eyes and antennæ and a little mesad are two simple eyes or ocelli; also between the antennæ and a little ventrad on the front is another ocellus. On the ventral surface of the head the beak or labium is attached. This is mainly characteristic

by its length, but does not afford such remarkable characteristics as the antennæ.

From a specific standpoint the latter appendages may be used with more value than any other feature, and in regard to which the following must be taken into consideration: The number of segments,[1] the total length, the length and color of each segment, the number and shape of the sensoria on each segment, and the union with the head. This union is carefully shown in each species illustrated, and also an enlarged figure of the third segment, showing approximately the kind and number of sensoria.

Another characteristic to be mentioned in connection with the head is the labium. (Plate I, fig. 1.) This is a greatly enlarged mouth-part, which in some specimens is larger than any other appendage. It has three or four segments, and in its normal position lies on the ventral surface of the body between the legs, as shown in plate IV, figure 25. On the ventral side of this is a canal, a cross-section of which is shown in figure 5. In this groove lie the mandibular and maxillary setæ, a cross-section of which is shown in figure 6.

The setæ are all separate at their proximal ends, but in the chitinous fold (fig. 3), which may be called the antelabial sclerite, they are all approximated. The maxillary setæ are quite firmly locked with their concave sides opposite to each other, thus forming a tube, a cross-section of which is shown, taken from the first segment. (Plate I, fig. 6, *A*.) These lie on the median chitinized ridge on the floor of the canal, for which see figures 3 and 6. On each side of this ridge is a similar chitinized line on which lie the mandibular setæ. (Fig. 3.) When the floor is narrowed, as is done in feeding, the latter chitinized areas are turned ventral side toward each other, thus appressing the mandibular setæ with their concave sides opposite, forming a tube in which are the maxillary setæ.[2] Thus each pair has a guide, in which they may slide lengthwise, and drill into the tissues of the plant, from which the sap is conveyed to the assimilative organs of the insect through the tube formed by the concavity of the maxillary setæ.[3]

1. The distal segment is not counted as such unless equal to or longer than the penultimate. Exceptions, however, are cited.

2. For treatise on the homopterous mouth-parts, see Walter J. Meek, K. U. Sci. Bull., vol. XII, No. 9, 1903.

3. Or, in other words, the labium ensheaths the mandibles, which in turn, by their concave interior surfaces, encompass and hold in position the maxillæ.

In connection with the labium may be mentioned the labrum (plate I, figs. 1 and 4), which is also prolonged distally into a sharp point. Its lateral edges are turned under so that they approximate on a median ventral line, which is chitinized. At the proximal end the folds diverge. This forms a sort of guide directly ventrad the antelabial sclerite, while the distal end of the labial sclerite extends a little beyond or caudad of this. The need of these two sclerites may be clearly understood when the motion of the labium is considered. For instance, suppose the insect to be in a feeding position. The setæ then are all straight, but when the insect removes the labium to its venter again, after feeding, it will then be at right angles to its former position, and the wire-like setæ will have been drawn nearly at a right angle over the antelabial sclerite. Again, when the labium is brought into a feeding position, the canal being shortened, will cause the setæ to be bent outward, but the labial sclerite helps to hold them in the canal, the latter being almost eliminated at this point on account of the bend. Therefore, on account of the motion of the labium and of the absence of the canal at this point, this need of special devices for holding the setæ may be seen.

The Abdomen.

The third division of the body is the abdomen. Its shape depends largely upon its distension. Since the latter varies with age or on account of food material, it is hardly necessary to formulate any characteristic basis upon its size. Its color and appendages, however, are of importance. And, in addition, there is present in some forms an external covering of pulverulent or cottony material. By the appendages are meant the honey-tubes[4] and the style. And although tubercles may be present, they are not considered as the former.

The honey-tubes are external openings on the dorsal side of the sixth segment. These are of various sizes and shapes. The four principal types may be defined as cylindrical, incrassate, clavate, and tuberculate. The first type is the most common, but it is seldom perfect. For instance, a honey-tube of two millimeters in length may be a shade narrower or broader in some part of its length and yet be defined as cylindrical.

4. The exact function of these organs has never been scientifically determined, but it has been lately conceded that they are purely excretional, and not "secretional." Other names used to denote these are horns, cornicles, nectaries, and siphuncles.

The second type or incrassate form is used to describe when the tube is distinctly enlarged or diminished in size or breadth. This irregularity may occur any place on the tube, but when at the distal end it is called clavate, and when in form of a gradual distension, as shown in figure 12, it may be called vasiform. The last or tuberculate type may partake of the first two forms, but is never longer than broad. For illustrations of these types, see plate II.

The second type of appendage under consideration is the style. It is an outgrowth of the last segment of the body. Of this there are about three predominant types. (See plate II.) The first may be defined as ensiform. This is predominant among the *Nectarophorini*. The caudal end usually tapers to a point, and is generally turned dorsad, causing the dorsal boundary line to become somewhat semicircular. The central part of the style may be its broadest division. The second or cone-shaped type is broadest at the base, from which it tapers to a point at the distal end. This form is common to the *Aphis*. The third type is known as globular. It may be constricted near the center, so that a knob is formed at the distal end. The knobbed is the larger form of this type. The other or subobsolete is similar in size and shape to the former, with the constriction and knob removed. The obsolete type of style is when the last segment is not lengthened by any projection. Such a form would be that shown in figure 26, plate IV.

The Thorax.

The second large division of the body is the thorax, which is similar to that of other insects. Consequently only the wings will be noted here as of special importance. It is from the venation of these that the subfamilies are mainly distinguished. When on foot most species carry their wings in a deflexed position; *i. e.*, the cephalic border or margin becomes the ventral margin and lies near the lateral margin of the body, and what is normally the caudal margin becomes the dorsal margin and approximates dorsad the abdomen. The cephalic pair of wings are much larger than the caudal pair, and in their color, venation and expansion depend specific characteristics. For illustration of terms used, see plates.

In the following descriptions of species the location and termi-

nation of the venation are not given, but are quite accurately shown in accompanying illustrations. The location of coloration is generally designated with stipplings. On the caudal margin of each large wing is a longitudinal fold by which the caudal wing is held in the same plane with the cephalic one by means of hooklets. This fold allows a sliding motion of the hooklets, which also allows the wings to be brought cephalad or caudad in the same plane, and at the same time firmly locked together. For further information concerning the wings, see descriptions opposite plate III.

Technique.

In the systematic study and collection of these insects the author at first took no single method, but after experimenting followed the ones herein mentioned as the most expedient and beneficial.

When collecting, bottles with large open mouths should be carried. Cotton is used instead of cork stoppers. When specimens are found, that part of the host-plant infested is detached and put into the bottles with the insects *in situ*. The insects will remain in a healthy condition when bottled in this manner to enable one to transfer them to the laboratory, where notes concerning their host-plant and also a brief description of them can be taken.

For the brief notes an especially prepared blank form is very convenient and expedient. It also serves as a guide which helps to insure against the omission of details. A type of this blank is shown under the head of "Color Key." This should be used for describing each fresh species, before it is treated with any chemical. A cover-glass will hold the specimen in position on the slide while the characters are noted by aid of a compound microscope.

After the specimen has been noted in the color key, some typical forms of it should be permanently mounted on a slide in balsam, and several specimens should be preserved in a vial of formalin of a five-per-cent. solution or alcohol of a seventy-per-cent. strength. The formalin is found to be superior in many respects to the alcohol.

In studying and classifying specimens, some typical forms may be removed and dehydrated with alcohol; only a few of the

higher grades need be used. These may be siphoned off from the insects after periods of thirty minutes each respectively. Clearing mixture[5] is the next reagent added, in which the specimens may remain fifteen minutes. From this they are removed and arranged on slides with dissecting needles, and on them is dropped xylol balsam over which a cover-glass is placed, but not pressed. As soon as the balsam is dry the insects are sufficiently cleared for study. The measure key[6] is now used for completing the characteristics not found in the color key. When it is desired to recopy the descriptions the aphid theme may be followed. This insures an orderly arrangement and the omission of no characteristics.

The accompanying illustrations were drawn with the camera lucida in some instances from this kind of mount, but more often from fresh specimens mounted by aid of no chemical other than Canada balsam.

Color Key.

Underscore terms used. Blanks are to be used for qualifying terms and comments.

Locality ..... Date .....
Acc. No. ..... Name .....

Head—black, green, brown ..... Stigma—black, gray, brown .....
Antennæ—concolorous ..... Femora—black, green .....
Eyes—black, red ..... Tibia—black, green .....
Beak—concolorous ..... Tarsi—black .....
Prothorax—black, green, brown ..... Abdomen—bare, pulverulent, cottony ....
Thorax—black, green, brown ..... Abdomen—green, black, brown .....
Wings—deflexed, reposed ..... Abdomen—other markings .....
Wings—clouded, banded ..... Honey-tubes—black, green, brown .....
Veins—black, brown ..... Style—black, green, brown .....
Host-plant: Common name ..... Genus ..... Sp. .....
Parts affected—leaves, part, dorsal, ventral, marginal, petiole, twigs, fruit, distal, proximal, trunk, roots, gall, pseudogall .....
Habits—aerial, subterranean, sporadic, gregarious, viviparous, oviparous .....
Comments: .....
.....
.....

5. Clearing mixture: Two parts by measure of carbolic acid crystals and three parts of rectified spirits of turpentine.

6. The color key and measure key should be printed on the same folder, for the sake of convenience.

Measure Key.

Underscore terms used and fill out blanks.

Acc. No..... Name.....

- Head
  - Antennæ
    - Hirsute .....glabrous.....
    - Length
      - Apparent, mm. I..II..III..IV..V..VI..VII..
      - Real, mm. I..II..III..IV..V..VI..VII..
      - Total length
        - Apparent, mm... .....
        - Real, mm.....
      - Extends.....
    - Sensoria
      - Circular, transverse.
      - Number, III....IV....V....VI....
  - Eyes
    - Ocular tubercles.....
    - Ocelli.....
  - Beak, length
    - Apparent, mm.....
    - Real, mm.....

Prothoracic tubercles: Present, absent.

- Wings
  - Venation.....
  - Stigma
    - Length
      - Apparent, mm.....
      - Real, mm.....
    - Breadth
      - Apparent, mm.....
      - Real, mm.
  - Total expansion
    - Apparent, mm.....
    - Real, mm.....
- Legs
  - Normal.....
  - Length of metatarsus
    - Apparent, mm.....
    - Real, mm.....

Tubercles.....

- Honey-tubes
  - Cylindrical, incrassate, clavate, tuberculate.
  - Extent, base of style, distal end.....
  - Length
    - Apparent, mm.....
    - Real, mm.....
- Style
  - Glabrous, hirsute.....
  - Ensiform, conical, globular, subglobular, obsolete.
  - Length
    - Apparent, mm... ..
    - Real, mm.....

Total length of body
- Apparent, mm.....
- Real, mm.....

Width of abdomen
- Apparent, mm.....
- Real, mm.....

Aphid Theme.

This key is followed when a final description is taken from the color and measure keys.

- Head
  - Color.
  - Antennæ
    - Color and covering.
    - Length of segments.
    - Total length.
    - Length in relation to the body.
    - Sensoria
      - Shape.
      - Number per segment.
  - Eyes
    - Color.
    - Ocular tubercles.
    - Ocelli.
  - Beak
    - Color.
    - Length.
    - Length in proportion to the body.

- Thorax
  - Prothorax
    - Color.
    - Lateral tubercles.
  - Mesa- and Metathorax
    - Color.
    - Wings
      - Color.
      - Venation
        - Color.
        - Normality.
      - Stigma
        - Length.
        - Breadth.
      - Total expansion.
    - Legs
      - Color.
      - Covering.
      - Normality.
- Abdomen
  - Color.
  - Tubercles.
  - Honey-tubes
    - Color.
    - Shape.
    - Length.
    - Length in relation to metatarsi.
    - Length in relation to the body.
  - Style
    - Color.
    - Covering.
    - Shape.
    - Length.
    - Length in proportion to honey-tubes.
  - Total length of body.
- Œcology
  - When found.
  - Host-plants
    - Number.
    - Position on.
  - Habitat.

The Wax Glands.

In aphids which secrete a waxy or woolly material there are certain glands in which the secretion is elaborated.

Some forms of plant-lice attract a great deal of attention on account of a flocculent material which seems to grow out from their bodies like the wool on sheep. Huber says that ants are known to keep a stock of "cows and goats." And his metaphor was not far-fetched, because from the habits of certain ants with aphids this statement is in one sense true. Although it is not known that the aphids use the "goats" as a commodity of any greater industry than they do the "cows." In fact, the wool does not seem to be of any particular use to them.

Is this wool an outgrowth of the epidermis? There seems to be only one brief answer on this point in former publications. And in this the author defines the secretion as being "forced through chitinous rims to cup-like glands, the glands arranged in clusters four to six or seven in a cluster, and each composed of numerous cells." From this it appears that the material does not grow out of the epidermis as hair or wool, but that there are certain glands which are situated near the epidermis that elaborate this so-called secretion.

Plate I, figure 1, is an illustration of an apterous, viviparous *Schizoneura lanigera*, which will serve to represent the location of one type of these glands. In this species they seem to be distributed in a uniform manner over the entire body. In appearance they resemble the blastula stage of an egg. (See fig. 1, *B*.) These glands are not composed of a uniform number of cells, but range in number up to twenty; and it is from these that the flocculent or woolly material comes.

Figure 2 is a gland of similar function which is found in *Pemphigus burrowi*. The material elaborated by this gland is more of a pulverulent nature than that secreted by *lanigera*. It also seems to be more impervious to water than the former. The glands are not as numerous in number, but they contain more cells than the other form.

In the first-mentioned type we find the production to be of a woolly or flocculent nature in appearance, but in composition it is more like asbestos, since it may be pulverized into a fine powder. In its normal state it acts as a protection against water, as also doubtless against extremes of weather, for this species is known to live in a temperature of 21 deg. F. Under favorable conditions this covering grows at the rate of eight millimeters or one-third of an inch per month, as was demonstrated recently in this laboratory.

Subfamilies of the Aphididæ.

1. Winged form unknown; subterranean in habit.....Rhizobiinæ.
   Winged form known; areal in habit.....2.
2. Antennæ three- to five jointed; fore wing with only two discoidals. Chermaphinæ.
   Antennæ six- to seven-jointed; fore wing with three discoidals.....3.
3. The third discoidal simple.....Pemphiginæ.
   The third discoidal branched.....4.
4. The discoidal with only one branch.....Schizoneurinæ.
   The discoidal twice branched.....5.
5. Antennæ six-jointed.....Lachninæ.
   Antennæ seven-jointed, rarely only six-jointed.....Aphidinæ.

Subfamily RHIZOBIINAE Passerini.

Antennæ five-jointed and short. Eyes small and inconspicuous, or none. Beak variable in length. Wings never acquired. Legs short and well developed. Tarsal claws not always distinctly separate, and sometimes only one is present, as in *Rhizobius*. Body somewhat short and somewhat convex dorsally.

It may be bare, hirsute, or tufted with setæ or flocculent material. Honey-tubes absent. Style absent or inconspicuous. These species are subterranean in habit and live on roots, and are found with ants.

Genus **Tychea** Koch.[7]

Antennæ composed of five joints, almost equal in length, the third a little the longest. Eyes none or very rudimentary. Beak variable in length according to age, but rather long and thick. Not known to acquire wings. Legs short. Honey-tubes, none. Style almost obsolete or none.

Genus **Trama** Heyden.[7]

Antennæ about one-half the length of the body, six-jointed, including the unguis; third joint the longest, and equal to the fourth and fifth together; fifth and sixth joints equal. Eyes very small and almost obsolete. Beak about two-thirds the length of the body. Not positively known to acquire wings. Legs long, particularly the hind pair, which possesses only one tarsal joint, which is equal to the femur in length; the other tarsi are two-jointed. Honey-tubes and style inconspicuous.

Genus **Forda** Heyden.[8]

Antennæ five-jointed, the third joint the longest. Eyes very small. No winged forms known. Abdomen convex. Honey-tubes absent. This genus has eyes and antennæ more simple than *Trama*. It feeds on grass roots and is often found in ants' nests.

Genus **Rhizobius** Burmeister. Plate IV, figs. 25 and 26.

Antennæ five-jointed, the first four nearly equal in length. Eyes inconspicuous. Beak very short, rising between the first coxæ. No winged form known. Legs short, the tarsi terminated with but one claw. Body has a coating to some extent of flocculent material. Honey-tubes and style absent. Different authors do not agree on the number of joints of the antennæ. Passerini says six, Fitch five or six, Thomas seven, and Buckton adds that the characters are very inconstant. This genus is subterranean in habit and lives on the roots of plants.

7. Although all the genera given do not have representatives in this text, it is nevertheless thought best to give the former that have been found in America.

8. No representative in text; genus? sp.

Head dirty gray. Antennæ a little darker and slightly pilose; length of joints: I, 0.10 mm.; II, 0.10 mm.; III, 0.18 mm.; IV, 0.28 mm.; V, 0.20 mm.; VI, 0.05 mm.; total length, 0.90 mm., not quite half the length of the body. Sensoria are absent except at the base of the unguis, where one is located. Eyes abnormal, small and black, with three ocelli instead of the common cornea. Ocelli not located in the normal position but cephalad and near the bases of the antennæ. They are large, translucent and situated in dark patches, each separate from the other. The beak is four-jointed, slightly hirsute and dark, except the first joint, which is lighter in color. Length, 3.44 mm., extending about one-half its length beyond the abdomen.

Thoracic lobes not distinctly divided, nor separate from the head. All grayish in color. The legs are darker than the abdomen, slightly pilose and stout. Honey-tubes and style entirely obsolete. Length of body, 2.08 mm.

This form was taken April 25, in an ants' nest which was in an old walnut stump in a small copse of timber. It is pulverulent and similar in action to other underground species.

From all appearances this form had hibernated in the ants' nest all winter. Only three were found. I expected to collect more during the summer, but none were to be found in the nest or on the trees in proximity to it.

Subfamily CHERMAPHINÆ.

Antennæ three- or five-jointed. Eyes nearly always large and prominent. Beak short, or never very long. Prothorax large, sometimes equally developed to the thorax. Cephalic wing with three simple oblique veins (plate III, fig. 22); caudal may or may not have an oblique vein. Legs short; tarsi with two claws. Honey-tubes absent.

This tribe is in many respects similar to the Coccidæ.

Genus **Phylloxera** Fonsc.

Antennæ three-jointed; the first and second short and nearly equal; the third the longest, imbricated; it has two sensoria, one circular one near the base and one more elongate near the distal end. Sometimes total length is equal to one-third the length of the body. Eyes small and almost rudimentary in the

apterous females. In the adult or winged form they are more normal. Beak absent in the perfect sexes, and moderately long. Wings rather large in proportion to the body; membrane delicate; upper wing with a well-marked subcostal from which spring three faint oblique simple veins. Caudal wing with a veinless cubitus. Both wings overlap and are held horizontally in repose. Legs very short; tarsi single-jointed according to previous description, but this is evidently an error, since I have found them to have two joints at all stages. The tarsi are furnished with two claws, two capitate bristles near the distal end, and a pulvillus. Abdomen globular in the apterous, and ovate in the winged forms. Honey-tubes absent.

Genus **Chermaphis** Linn.

Antennæ very short, reaching but little beyond the neck when turned back, composed of five joints, the two basal joints short, the remaining ones generally subequal in length, the fifth oval. Front wings rather large, transparent, the two discoidals and stigmatic veins appearing as three oblique branch veins; stigma usually elongated and much pointed at the tip. Hind wings with one more or less distinct branch vein.

Legs in the winged individuals rather short, the posterior pair usually not longer than the middle pair, all rather short; in the apterous individual very short. Body of the winged individual regularly oval; of the apterous, nearly circular and convex. No honey-tubes. Usually more or less covered with a cottony secretion.

The species so far as observed appear to be more particularly confined to coniferous trees.

Phylloxera caryæcaulis Fitch. Plate IV, fig. 27.

Head dark. Antennæ dark, imbricated, and composed of three joints; length of segments: I, 0.03 mm.; II, 0.01 mm.; III, 0.16 mm.; total length, 0.21 mm., extending to the wing insertions. There is one circular sensorium on the third joint about one-third of the length of the joint from the base. On the distal third is what appears to be an elongate sensorium which is not distinct. Eyes red; ocular tubercles present; ocelli prominent and red. Beak dark, 0.18 mm. long, extending to the mesocoxæ.

Prothorax pale yellow. Thorax a shade darker yellow;

wings pellucid, venation not distinct but darker than the remainder of the wing. Stigma dark, sometimes extending to the proximal part of the wing, but generally more normal, as shown in the illustration, being 0.09 mm. broad, and 0.36 mm. long. Legs pale yellow, slightly hirsute, and normal in length; tarsi (two-jointed in young and old) normal, except being mounted with two capitate hairs near the claws, as shown in the illustration. Other hairs, but not capitate, are present, as shown in the figure.

Abdomen greenish yellow. Honey-tubes obsolete. Abdomen nearly always drawn out pointed at the distal end. Total length of the body, 1.09 mm. For an illustration of the apterous stem-mother, see plate XXII, figure 101.

This form was taken May 25, on hickory (*Carya amara*). The forms are gregarious and live in reddish galls on the main trunk of the tree. Following is Mr. Burrows's description of the gall:[9]

"*Phylloxera caryæcaulis* (?) FITCH. This species forms large stem galls on the hickory (*Carya amara*). The gall is bullet-shaped, with a tough leathery covering; green when young, turning to a red in the sunlight, resembling a large strawberry. These galls are about 25 mm. in diameter, with a large hollow cavity enclosed by a wall 2 mm. in thickness, which is covered with yellow lice. The galls appear about April 15, and winged lice appear about May 26, and even in June I have seen small green galls from which aphids emerged. I am inclined to believe that there are two broods of gall-making stem-mothers of this species during the year. The galls appear on the twigs and young shoots of the tree, and are deformed buds as far as I have observed. On the upper surface of the gall I have found several growing bunches of leaves which were normal leaves of the deformed bud. A slight evidence of deformed leaves may be found in the thick, succulent walls of the young galls."

Subfamily PEMPHIGINÆ.

Antennæ short, with five or six joints. Third joint the longest, and about equal, when six-jointed, to the three following taken together. The third and following joints are nearly always annulated with transverse sensoria, but when not annu-

9. From M. T. Burrows's unpublished manuscript on galls.

lated the sensoria are circular. Eyes large in the winged form, but in the gall-inhabiting, apterous form they may be small or absent. Beak long in the adult, or absent in the true sexes. Thorax generally well arched. Wings moderately long. The third discoidal is simple and hyaline or obsolete at the base. The first and second discoidals usually start from the same point or not far apart. The caudal wing has two discoidals (except in *Hormaphis*, which has but one), which arise from an angle in the subcostal vein. Legs short; tarsi with two claws and sometimes with a pair of capitate hairs. Honey-tubes obsolete. Style inconspicuous or none.

Genus **Hormaphis** Osten-Sacken.[10]

Antennæ five-jointed; first and second short, third the longest, fourth and fifth subequal; the last three joints strongly annulated. Eyes conspicuous. Beak moderately long. Front wings with two discoidals starting from the same point; the third discoidal is simple and almost obsolete at the base. Hind wings with a single discoidal which is almost obsolete. Legs moderately long; tarsi mounted at the distal part with two long capitate hairs. Honey-tubes and style absent.

Genus **Tetraneura** Hartig.

Antennæ short, extending nearly to the abdomen; the third joint distinctly annulated. Beak short. Wings with a simple cubital which is obsolete at its base; stigma large and trapezoidal; the first and second discoidals usually arise at the same point. The subcostal vein of the caudal wing with only one discoidal. Legs short. Honey-tubes and style obsolete.

Genus **Geoica** Hartig.[11]

Antennæ five-jointed, not annulated; first and second joints short; third longest; fourth and fifth shorter, subequal, often connate, the fifth with a short, thick spur at the tip. Sensoria present on the third antennal joint of the winged individual, and in all of the forms at the apex of the fourth joint and base of spur on the fifth, the latter sensorium lunate in the wingless individuals. None present on the tibia of the oviparous female. Eyes distinct. Beak rather short and thick, last two

10. No representative of this genus described in this text.
11. No representative in text.

joints longer than the basal portion. Fore wings with the stigma large, the cubital simple, obsolete basally, the two discoidals united at the base. Hind wings without discoidal vein. Two distinct tarsal joints and two claws on all the legs. Anal plate flattened, drawn forward dorsally and compressing middle of posterior segments, cauda short, transverse, inconspicuous. Cornicles and excretory glands wanting.

Genus **Pemphigus** Hartig.

Antennæ not more than half the length of the body, six-jointed; third joint about equal to the three following taken together; third, fourth and fifth joints commonly annulated. Eyes large in the winged form, but often rudimentary or absent in the apterous form. Beak moderately long in the adult, but much longer in the young. The first two discoidals arise from nearly the same point, the third is simple and obsolete at the base; stigma rather short and broad. The two discoidals in the caudal wing arise from somewhat of an angle in the subcostal vein. Thorax much developed and distinctly arched. Legs moderately long in the winged form, but short in the apterous form. Honey-tubes absent. Style rudimentary or absent.

Pemphigus burrowi, n. sp. Plate IV, fig. 30.

Head black. Antennæ slightly hirsute, and concolorous with the head; length of segments: I, 0.05 mm.; II, 0.07 mm.; III, 0.21 mm.; IV, 0.09 mm.; V, 0.11 mm; VI, 0.16 mm., including unguis, which is 0.03 mm.; total length, about 0.65 mm. Sensoria mostly transverse, but not encircling the segments as do the sensoria of the *S. americana;* on the third joint are five or six; on the fourth one; on the fifth are five circular ones in a circular patch at the distal end of the segment, each bordered with a fringe of four or five bristles. The sixth has an irregular patch of nearly circular sensoria near the distal end which are bordered with bristles. The eyes are black; ocelli not prominent, but those near the eyes border them dorsocephalad very closely. On the front is the one most prominent between the bases of the antennæ. All are bordered with black. The beak is dark and extends midway between the first and second coxæ, being 0.34 mm. long.

The prothorax is whitish and very short. The thorax is

strongly arched and black. Wings are hyaline. Subcostal vein robust, discoidals slender. Third discoidal obsolete at the base. All the veins are nearly obsolete at their distal margins. Stigma, costal and subcostal uniformly of a brownish black. Stigma, 0.18 mm. broad and 0.75 mm. long. Distal part of stigma sharp in some, in others more rounded. Total wing expansion, 6.61 mm. Legs dark and slightly pilose, also short in proportion to the body. The distal joint of the tarsus is exceptionally long. Honey-tubes and style are absent. Abdomen pale yellow, with no honey-tubes or style; total length of body, 2.35 mm.

This form is gregarious and apparently subterranean in habit. April 30 the winged form was taken on the roots of the nasturtium (*Nasturtium sinuatum*). The forms at that time seemed to be developing wings for migration. Soon after this time the Kaw river valley was inundated and none of these forms have been taken since. On account of their pulverulent secretion they can withstand a small amount of water, but enough to kill their host-plant is too much for them.

Pemphigus fraxinifolii Riley. **Plate IV, fig. 28.**

Head dusky. Antennæ dusky and bare; length of segments: I, 0.05 mm.; II, 0.07 mm.; III, 0.25 mm.; IV, 0.12 mm.; V, 0.16 mm.; VI, 0.28 mm., including the unguis; the unguis alone, 0.03 mm.; total length of the antennæ, 0.93 mm., extending to the abdomen. Sensoria irregularly circular or nearly transverse, but not encircling the segment; seven on the third joint, four or five on the fourth, the proximal one being quadrate in outline; six or seven on the fifth, the distal one being very irregular in outline; about four on the sixth, the distal one being at the base of the unguis. Eyes black; ocular tubercles quite prominent; one frontal ocellus and three dorsal pairs. The extra two dorsal pairs near the median line may not be ocelli, but they resemble them very much in appearance. Beak dusky, 0.45 mm. long, extending a little more than midway between the pro- and mesocoxæ.

Prothorax short, conspicuously marked with two light-colored circular spots. Thorax dusky, marked near the ventral part with two pear-shaped light spots, as shown in the illustration. Wings hyaline, with slender pale and frail veins. Stigma,

0.18 mm. broad and 0.81 mm. long. What appear to be sensoria are situated along the subcostal vein near the stigma. An enlarged view of the same is shown at *a*, in the illustration. Total wing expansion, 6.00 mm. Legs normal, with the exception of long tarsi, they being 0.25 mm. long.

The abdomen is dark green or yellowish green after the cottony secretion is removed. Honey-tubes and style obsolete. Total length of the body, 1.82 mm.

This form was taken June 21, on the ash (*Fraxinus americanus*). It is gregarious, and colonizes the terminal leaves, which causes them to curl and form a pseudogall that protects the lice.

Pemphigus populicaulis Fitch. **Plate VI, fig. 40.**

Apterous form.—Head black. Antennæ black; length of joints: I, 0.03 mm.; II, 0.05 mm.; III, 0.10 mm.; IV, 0.07 mm.; total length, 0.25 mm. Eyes black, the cornea, of which there are three, resemble ocelli, and lie in the black pigment of what corresponds to the eye. Beak black, 0.27 mm. long, extending midway between the pro- and mesocoxæ.

Thoracic divisions not differentiated from the remainder of the segments. Legs black and short.

Abdomen large and spherical, also pulverulent. Honey-tubes and style obsolete.

This form was taken May 17, in a cottonwood gall. This gall is on the petiole at the base of the leaf. The interior of the gall is smooth, and contains besides the exuviæ of the lice several liquid globules coated with a pulverulent matter which gives it the appearance of mercury in its behavior, since it retains a globular form. All the insects in the gall, sometimes numbering 500, have this same coating of pulverulent matter. They are produced at the rate of about ten per day. Usually there is but one viviparous mother in the colony, but sometimes two are found. An illustration of the stem-mother is shown in plate V, figure 34. These forms were taken July 17. The adults are at this time leaving the galls, but they were not found in any other place. Yet, under artificial conditions, they were observed laying their eggs on apple twigs.

Following is Mr. Burrows's description of the gall: "This gall occurs throughout the summer on the petiole of the leaf of the cottonwood (*Populus monilifera*). The gall is a subglobu-

lar, swelling slightly, elongated towards a lip-like opening; 15 mm. in diameter; green while growing, but of a straw color at maturity; walls thick, firm, and succulent. The opening is short and is always parallel with the lower border of the leaf. The petiole bends nearly always to the left around the outer border of the gall at an angle a little greater than a right angle. The young lice remain in the gall until maturity."

There are many broods of this gall produced throughout the summer. They are seen in the early spring and in the late fall. Very common.

Pemphigus populicaulis Fitch. Plate V, fig. 33.

Head dark brown. Antennæ dark; length of segments: I, 0.05 mm.; II, 0.05 mm.; III, 0.16 mm.; IV, 0.07 mm.; V, 0.09 mm.; VI, 0.14 mm., including the unguis; unguis alone, 0.01 mm.; total length of antennæ, 0.54 mm., extending to the insertion of the front wings. Sensoria transverse, nine on the third joint, and at the lateral inner margin of the third sensoria is a short conspicuous spur, similar to the one on the first sensoria of the *populitransversus*. Three sensoria on the fourth joint, three on fifth, with an irregular sensorial near the distal end which contains a few small circular sensoria. On the sixth are five transverse sensoria, while an irregular sensorial patch is near the distal end. Eyes are black, ocular tubercles not very prominent, ocelli large, but not conspicuous. Beak extends midway between the pro- and mesocoxæ, being 0.36 mm. long.

Prothorax short and lighter in color than the head; thorax dark brown. Wings hyaline, veins dark, stigma is lighter in the central part than the subcostal vein; 0.41 mm. long by 0.14 mm. broad. Total wing expansion, 4.50 mm. The two discoidals of the hind wing seem to arise from each side of the subcostal. Legs black and rather small in proportion to the body.

Abdomen greenish and pulverulent. Honey-tubes obsolete. Style not conspicuous but the abdomen ending with a somewhat conical segment. Total length of the body, 3.26 mm.

This form is very similar to the *populitransversus* but is most easily distinguished by having more sensoria on the antennæ. It is gregarious and forms a gall on the cottonwood (*Populus*

monilifera?) similar to that formed by the other species, yet differing in that the petiole seems to be twisted or folded so that the gall is formed. It is from a fourth to three-fourths of an inch in diameter, with a narrow transverse opening on one side where the petiole overlaps, which allows the emigration of the adult forms.

Pemphigus populitransversus Riley. Plate IV, fig. 29.

Head and antennæ black. Length of segments: I, 0.09 mm.; II, 0.09 mm.; III, 0.02 mm.; IV, 0.09 mm.; V, 1.28 mm.; VI, with unguis 1.64 mm.; unguis alone, 0.03 mm.; total length, 0.74 mm., extending to the insertion of the fore wings. Sensoria transverse and broad, but not completely encircling the joints of the third and fourth segments. Three or four sensoria on the third segment, also a characteristic spur at the inner lateral border of the first sensorium. Two sensoria on the fourth, a large circular patch containing three or four small circular sensoria, which have ten or twelve small papillary hairs on their surfaces. One large sensory patch on the sixth near the unguis, which has in it two or three small circular sensoria containing hairs similar to those of the fifth sensorium. Unguis is armoured with about six small, sharp bristles at its distal end. Eyes black, ocular tubercles prominent, ocelli three, and not very conspicuous. Beak dark, 0.27 mm. long, extending a little beyond the first coxa.

Prothorax smoky; thorax black and arched. Wings hyaline, with a brownish venation. Stigma uniform in color, 0.72 mm. long by 0.20 mm. wide. Total wing expansion, 6.64 mm. Legs black, slightly hirsute.

Abdomen smoky yellow. Honey-tubes and style absent. Total length of body, 2.72 mm.

This form was taken the 8th of October, on the cottonwood (*Populus monilifera*). It is gregarious in habit, living in a gall in the distal end of the petiole. This gall is from one- to three-fourths of an inch in diameter. It has a small transverse opening near and parallel to the base of the leaf, through which the adults emerge. In these colonies of from a hundred to four hundred is one and sometimes two stem-mothers. These are apterous and reproduce viviparously at the rate of about ten per day. In these galls are numerous globules of liquid which

has a waxy coating that gives it a similarity to mercury in action and appearance. The insects also have this pulverulent coating.

Tetraneura ulmi De G. Plate V, fig 34.

Head black. Antennæ dark and annulated; length of segments: I, 0.01 mm.; II, 0.03 mm.; III, 0.16 mm.; IV, 0.07 mm.; V, 0.05 mm.; VI, 0.06 mm., including the unguis; unguis alone, 0.01 mm.; total length, 0.43 mm. Eyes black and large in proportion to the head; ocular tubercles present; ocelli large and of a reddish color. Beak dark, 0.18 mm. long, extending midway between the pro- and mesacoxæ.

Prothorax brownish, short and almost covered dorsally by the mesathorax. Latter dark; wings pellucid, venation dark. Stigma, 0.14 mm. wide and 0.45 mm. long. Total wing expansion, 4.84 mm. Legs dark, slightly hirsute, and normal in length.

Abdomen yellowish brown. Honey-tubes tuberculate. Style obsolete. Total length of body, 1.99 mm.

This form was taken June 26, on the elm (*Ulmus americana*). It is gregarious, and lives in what is known as a cockscomb gall. Following is Mr. Burrows's description of the gall: "This species forms a cockscomb-like gall on the upper side of the leaf of the elm (*Ulmus americana*) in June, on the outer young leaves. The gall is usually about 25 mm. in length and about 8 mm. in height, and is very conspicuous, being truly cockscomb-shaped. Its sides are grooved with perpendicular wrinkles and its summit toothed. In early summer the gall is a light green color, lighter than the leaf, turning red after some exposure to the sun. It dies and becomes a straw color when the insect emerges. The gall has an external opening on the under side of the leaf, which is a slit-like orifice. The interior of the gall has wrinkles corresponding to the exterior. These galls are not common in this region, being obtained from only one small elm tree on the Wakarusa river, July 1. This species attacked only the young trees, as far as could be observed; the larger trees surrounding this tree had no galls, while this young tree and surrounding sprouts were covered with them. Riley[12] says that there are several generations of this gall-producing

12. Riley, Bull. U. S. Geol. Surv., vol. V, p. 9.

insect during the year, containing but two broods of gall-making females, and that no galls are formed except by the stem-mothers that hatch from the impregnated egg."

Mr. Burrows is working on gall-producing insects, which is collateral to this subject, and it is from some of his unpublished manuscript that this reference is taken. Our collecting has been done in the same locality.

Subfamily SCHIZONEURINÆ.

Antennæ short, about half the length of the body or shorter. Six-jointed. When annulated, with transverse sensoria, or when not annulated, with circular sensoria. Eyes in winged form conspicuous, rudimentary or obsolete in some of the apterous forms. Beak in young forms may extend to the caudal end of the abdomen, moderately long in the adults and absent in some of the true sexes. Thorax moderately arched. The first and second discoidal of the cephalic wing usually arise near each other. The third discoidal is once branched and obsolete at the base. Caudal wing may have one or two discoidals. Abdomen generally has a flocculent or pulverulent covering. Honey-tubes rudimentary or absent. Style inconspicuous, globular, or obsolete. The species in this subfamily may vary in habit, some being subterranean, and some gall-inhabiting, while others may live unprotected.

Genus **Colopha** Monell.

Antennæ six-jointed, third joint as long as the three following and not extending beyond the thorax. Beak short. First two discoidals of the front wing arising from nearly the same point, cubital once branched. Caudal wings, with only one discoidal. Honey-tubes and style wanting.

Genus **Toxoptera** Koch.[13]

Antennæ seven-jointed, on small remote frontal tubercles. Beak moderately long, extending to the mesacoxæ. Cephalic wings, with the cubital vein but once branched. Subcosta of the caudal wings with two discoidals. Legs stout and moderately long. Honey-tubes cylindrical and moderately long.

13. No representative in text.

Genus **Schizoneura** Hartig.

Antennæ six-jointed; the third joint the longest, fourth and fifth about equal in length. When annulated the sensoria are transverse, and when smooth the sensoria are circular. Beak moderately long in the adult, sometimes extending to the metacoxæ; in the young it sometimes extends to the end of the abdomen. Wings moderately long; the first two discoidals of the cephalic wing arise close together; the cubital is obsolete at the base and once branched. Subcostal vein of the caudal wings nearly straight, with two discoidals. Legs short. The body, with but few exceptions, is covered with a pulverulent or cottony secretion. Honey-tubes rudimentary or absent. Style obsolete or rudimentary.

Schizoneura americana Riley. Plate VI, fig. 37.

Head black. Antennæ dark, bare, and annulated with sensoria; length of joints: I, 0.05 mm.; II, 0.05 mm.; III, 0.37 mm.; IV, 0.09 mm.; V, 0.10 mm.; VI, 0.09 mm., including the unguis; latter alone, 0.01 mm.; total length of antennæ, 0.75 mm., extending to the insertion of the caudal wings. Sensoria transverse, about twenty-two on the third, four to six on the fourth, four to six on the fifth, about three on the sixth; also three or four small circular ones at the distal end of the sixth or base of the unguis. The distal end of the latter is armed with four or five short capitate hairs. Eyes black; ocular tubercles present but not prominent; ocelli present and conspicuous. Beak dark, 0.81 mm. long, extending to the mesocoxæ.

Prothorax short and dark; wings hyaline, venation medium in width, each bordered with a very faint smoky tinge on each side about twice as wide as the vein itself. Stigma dark, 0.19 mm. broad and 0.63 mm. long. Total wing expansion, 5.80 mm. Legs black, slightly hirsute, and normal.

Abdomen reddish brown; honey-tubes present but not conspicuous, being almost obsolete. Style obsolete. Total length of the body, 2.44 mm.

This form was taken June 16, on the elm (*Ulmus americana.*) They colorize the ventral side of the leaves, causing them to curl. When numerous they give the leaves a whitish appearance and cause the terminal ones to bunch together, which gives the lice more protection. When the leaves begin to turn yellow

and look sickly from the attack of the aphids, the latter are acquiring wings and beginning to migrate. This migration, according to my friend Mr. E. H. Tucker's observation, takes place most conspicuously about twilight, for he says: "In the twilight of the evening I took several winged specimens. The air had floating in it numerous white insects. After capturing some I noticed that it was a cottony secretion which gave them their white appearance and also sustained them or caused them to be wafted along by the wind." According to this statement, the flocculent material acts as a sail by which these insects are carried as well as by the aid of their wings.

Schizoneura lanigera Hausm. Plate V, fig. 36.

Head black. Antennæ dark brown; length of joints: I, 0.07 mm.; II, 0.07 mm.; III, 0.469 mm.; IV, 0.109 mm.; V, 0.128 mm.; VI, 0.09 mm., including the unguis; total length, 8.5 mm. The sensoria are transverse, and give the antennæ an uneven appearance. There are on the third joint twenty-two, on the fourth joint five, on the fifth joint four, and on the sixth three. The eyes are dark brown, ocular tubercles are not conspicuous, ocelli normal. The beak is concolorous with the prothorax, and extends to the mesocoxæ, being 0.81 mm. long.

The prothorax is pale brown. The thorax is black on the sclerites and the membrane is pale brown. The wings are not clear. The venation is brown. The stigma is brown and 0.198 mm. broad by 0.50 mm. long. Total wing expansion, 9.4 mm. The legs are somewhat hirsute; femur dusky, approaching black at the distal ends; tibia and tarsi pale prown.

The abdomen is dusky brown; honey-tubes tuberculate, concolorous, and not very conspicuous; style is obsolete.

This form is quite common the whole year (as far as known it affects all cultivated apple trees except Northern Spy and Winter Majetan), but the winged state is rarely met. The winged form was taken on the 27th of October from an old scion apple orchard, in colonies with the wingless forms. The species is gregarious and may be located by the woolly secretion which grows out from certain glands on their bodies, as shown in figure 7. This is the typical underground and aerial form. It is not only found on the roots of the apple tree, but also on

the tender bark, whether it be in a crevice or exposed, as on the water sprouts. The places most adaptable for them are on the tender bark which is overgrowing a wound where a branch has been pruned off. The secretion of the underground form is more of a pulverulent nature, and is impervious to water. This secretion on the aerial form grows out at the rate of 0.50 mm. per week, as found by actual experiment, and on account of this protection no parasites molest them as they do the less protected genera.

Schizoneura lanigera Hausm. Plate II, fig. 7.

Entire body chocolate brown after the bluish-white cottony secretion is removed. Length of antennal joints: I, 0.03 mm.; II, 0.05 mm.; III, 0.09 mm.; IV, 0.03 mm.; V, 0.07 mm.; VI, 0.07 mm., including the unguis; latter alone, 0.01 mm. A circular sensorium at the distal end of the fifth and the sixth joints. Eyes black; not hemispherical, as is normal, but small and black, with three or four of the cornea appearing as large and translucent ocelli. Ocular tubercles and ocelli absent. Beak, 0.36 mm. long, extending near to the second coxa. In the very young larva the beak is equal to the body in length.

Thoracic segments all similar and not characterized as lobes. Legs short. Abdomen large in proportion to the anterior divisions, and is about as broad as long. Honey-tubes almost obsolete, style not well developed, subobsolete, twice as wide as long, 0.07 mm. long and 0.14 mm. wide.

This form was collected with the winged form described. It is gregarious and colonizes the sprouts, wounded places and tender bark on the trunk and limbs, but is not found on the leaves.

Schizoneura corni Fab. Plate VI, fig. 38.

Head black. Antennæ dark and hirsute, about half as long as the body; length of segments: I, 0.054 mm.; II, 0.07 mm.; III, 0.198 mm.; IV, 0.09 mm.; V, 0.109 mm.; VI, 0.145 mm., including the unguis, which alone is 0.036 mm.; total length, 0.67 mm. The sensoria are large and circular; about six on the third joint, two on the fourth, two on the fifth, and one on the sixth at the base of the unguis. The eyes are black; ocular tubercles present; ocelli present but not very prominent.

Beak dark brown, extending to the mesocoxæ, being 0.54 mm. long.

The prothorax is broad and short; thorax broad; wings hyaline and covered with minute stipples; veins slender and brownish; cubitus obsolete at the base. Stigma brown and 0.50 mm. long by 0.198 mm. wide. Total wing expansion, 6.94 mm. Legs black and hirsute, metathoracic legs long in proportion to the others.

The first three segments of the abdomen are ferruginous, as are also the apical segments; remainder of the abdomen black. Honey-tubes reduced to a mere circular opening, and not very conspicuous. Style obsolete.

This form was taken in October on the ventral side of the leaves of the dogwood. It is gregarious and was found in great numbers. Later in the season it was found somewhat sporadic on a great many other plants in the vicinity of the dogwood, from which it seemed to have migrated.

Schizoneura, n. sp. Plate VI, fig. 41.

Head black. Antennæ black, bare, and uneven; length of segments: I, 0.03 mm.; II, 0.03 mm.; III, 0.21 mm.; IV, 0.07 mm.; V, 0.09 mm.; VI, 0.10 mm.; total length, 0.53 mm., extending to the wing insertion. Sensoria transverse, sixteen to twenty-four on the third joint, four on the fourth, eight to ten on the fifth, and eight or nine on the sixth. The distal end is armed with several spines. The eyes are dark red; ocular tubercles prominent; ocelli present, but not very conspicuous. Beak dark; in the pupa it extends to the mesocoxæ and is 0.27 mm. long.

Thorax all dark; wings pellucid, veins black; the discoidals and stigmal veins have a smoky border about equal in width on each side to the vein itself. Stigma black, 0.09 mm. broad and 0.36 mm. long. Total wing expansion, 3.60 mm. Legs dark, hirsute, and normal in length.

Abdomen dark brown. Honey-tubes tuberculate. Style obsolete.

This form was taken June 19, on the elm (*Ulmus americana?*). It is gregarious in galls, which my coworker describes as a new species. Following is his description: "This gall occurs on the dorsal side of the leaf of the elm (*Ulmus americana?*). The

gall is large and elongated, tapering at both ends; sides sunken and irregular, due to the thin wall of the central cavity; 2½ c. in height and 1 cm. at its greatest diameter. The walls are of a leathery texture, green when young, turning to a straw color upon reaching maturity. The gall is firmly fastened to the leaf. The internal side of the gall is covered with plant-lice which emerge through a crack which occurs along the side of the gall, or some few through the small opening on the ventral side of the leaf."

The aphid is doubtless a new species which is somewhat similar to *Colophia ulmicola* Fitch, but does not agree with it on account of its tuberculate honey-tubes and two discoidals in the caudal wing. The illustration was made from a mutilated specimen and consequently does not show all the parts perfectly.

Subfamily LACHNINÆ.

Antennæ generally equal to half the length of the body, six-jointed. Beak long, extending to or beyond the mesocoxæ. Cephalic wings with three discoidals, the third one twice branched. Stigmal vein nearly straight, stigma extra long, inframarginal cell long and narrow. Caudal wings with two discoidals. Legs extra long, especially the tibiæ of the hind pair. Tarsi normal. Abdomen large and broad. Honey-tubes tuberculate, somewhat inconspicuous. Style globular, inconspicuous or absent.

This subfamily comprises our largest aphids. They live unprotected and are usually gregarious on the limbs and trunks of trees. Their coloration is of a protective nature, being similar to the surface on which they are found.

Genus **Lachnus** Bermeister.

Antennæ about half the length of the body, six-jointed; the third joint is the longest; the fourth, fifth and sixth are nearly equal in length. Beak very long, never shorter than half the body and sometimes much longer. Wings long and broad, stigma unusually long and narrow. The third discoidal is twice branched, and the stigmal vein is nearly straight. The caudal wing has two discoidals. Legs very long, especially the hind pair. Honey-tubes tuberculate. Style inconspicuous or obsolete. This genus comprises some of the largest aphids known.

Genus **Phyllaphis** Koch.[14]

Head convex and smooth. Antennæ moderately long, the third joint nearly twice the length of the fourth, the fifth equal to the sixth in length. Beak very short, wings long and broad, stigma long and trapezoidal, veins clear Body covered with a cottony secretion. Honey-tubes rudimentary. Style almost obsolete.

Lachnus longistigma Monell. Plate VI, fig 39.

Head dark brown. Antennæ of a darker brown, except the base of the third segment which is a lighter brown; all the joints are hirsute; length of joints: I, 0.19 mm.; II, 0.199 mm.; III, 1.23 mm.; IV, 0.59 mm.; V, 0.59 mm.; VI, 0.39 mm., including the unguis, which is 0.11 mm. long; total antennal length, 3.15 mm. Sensoria large and circular but indistinct; eight on the third joint in a single row; three small and two large ones on the fourth joint; one near the distal end of the fifth as large in diameter as the segment itself; one large with four small laterad this at distal end of the sixth proper, and one small at the base of the unguis. Three large sensoria on the subcostal vein of the front wing. Eyes are black, and the ocular tubercles are small. The two dorsal ocelli are not as prominent as the cephalic one. The beak is concolorous with the head and extends a little caudad of the mesocoxæ, being 0.27 mm. long.

The prothorax is short and narrower cephalad than caudad. The thorax is dark brown. The wings are light brown, venation brown or dark. The first two discoidals are robust, with smoky borders. The cubitus is frail, faintly bordered with brown, and obsolete at the base. Stigmal vein is nearly straight and very faintly bordered with brown. The coloration of the subcostal extends around the distal end of the wing, ending between the distal end of the third cubital and the stigmal vein. The stigma is 0.90 mm. long by 0.22 mm. broad. The distal end of the stigmal cell is plainly marked, making the stigmal cell alone 0.22 mm. long, but the stigma proper, 2.17 mm. long. Total wing expansion is 19.00 mm. The caudal wing shows a marked peculiarity toward specialization in that it often has the second discoidal branched. The costal vein has

14. No representative in text.

a broad border of brown which also borders the subcostal vein. This latter vein seems to arise distad of the second discoidal, and from this point it gradually extends in breadth to the base of the wing. There are ten hooklets on this wing. The legs are hirsute; femora reddish yellow proximad, and the remainder of the leg black. The metathoracic legs are abnormally long. The others are also long in proportion to the body.

The abdomen is large and hirsute, having a grayish general appearance. One lateral black spot on each tergum. Honey-tubes are concolorous with the abdomen, and are as broad as long, tuberculate, and 0.50 mm. long. The style is obsolete. Entire length of the body, 7 mm.

This form has been numerous here all summer. They are gregarious and colonize the small limbs and trunks of trees. They are very gentle and droll-like in their habits. In cold weather they collect on the under side of the limbs, and insert their beaks, which seem to support them when their feet become too numb to support them. Even after they are dead they still remain on the limbs clinging with their beaks. In endurance of extremes of weather they are similar to the *Schizoneura lanigera*. They were among some of the first winged forms to appear this spring and were the last to disappear, having endured all temperatures from — to zero, F.

On account of their feeding habits they can live through the winter where it gets no colder than zero, since they feed from the sap of the tree and not from the sap of the leaves. This is the largest aphid known. Following are the food-plants upon which I have found it this year (1903): Soft maple (*Acer dasycarpum*), Pig hickory (*Carya amara*), Black walnut (*Juglans nigra*), oak (*Quercus marylandica*), *redbud* (*Cercus canadensis*), sycamore (*Platanus occidentalis*), and cottonwood (*Populus balsamifera*).

Subfamily APHIDINÆ.

Antennæ seven-jointed, moderately long, often longer than the body. Eyes present, with distinct ocular tubercles (except in *Callipterini*). Beak variable in length. Cephalic wings with three discoidals; third one twice branched; stigmal vein curved. Caudal wings with two discoidals. Legs generally of a moderate length. Tarsi two-jointed and with two claws (ex-

cept in *Mastopoda*). Honey-tubes of different lengths, seldom tuberculate or absent. Style always present.

This is one of the largest subfamilies. In habit the species are the most variable.

For convenience this subfamily may be divided into the three following tribes:

3. Antennæ on conspicuous frontal tubercles; style long, never shorter than the tarsi.....*Macrosiphini.*
   Antennæ on inconspicuous frontal tubercles or none; style short or none, never longer than the tarsi..... 2.
2. Style conical; honey-tubes cylindrical, or rarely incrassate.....*Aphidini.*
1. Style obsolete or globular; honey-tubes tuberculate, or distinctly incrassate.....*Callipterini.*

Tribe CALLIPTERINI.

Antennæ not constant, as a tribal characteristic, being variable in length, sometimes shorter, sometimes longer, than the body; when shorter they are generally hirsute; always seven-jointed, but the seventh may not always be as long as the sixth; never on frontal tubercles (except in *Drepanosiphum*). Beak short (except in *Melanoxanthus*). Wings often clouded by vein borders or patches. Abdomen usually elongate and somewhat flat, often tuberculate or hairy. Honey-tubes, when tuberculate, strong, distinctly incrassate or obsolete. Style globular or none.

Genus **Cladobius** Koch.[15]

Vertex flat between the antennæ. Antennæ seven-jointed and about half the length of the body; the third joint about twice the length of the fourth. Beak extending to the mesocoxæ. Prothorax with a lateral tubercle. Wings moderately long. Legs normal and hirsute. Abdomen oval. Honey-tubes vasiform. Style globular or absent.

Genus **Chaitophorus** Koch.

Front of head tufted with bristles. Antennæ hirsute, seven-jointed, about half the length of the body. Beak short, sometimes extending a little caudad of the mesocoxæ. Wing venation normal, with the addition of smoky borders and spots. Legs hirsute and moderately long. Abdomen usually tuberculate, and with long slender hairs, which are never capitate,

15. No representative in this text.

as is often the case in *Callipterus*. Honey-tubes short and thick, tuberculate, rarely subobsolete. Style tuberculate.

Genus **Callipterus** Koch.

Head large, vertex flat. Antennæ smooth, usually about as long as the body but sometimes much longer, seven-jointed, seventh joint rarely less than the sixth,[16] but variable in length. Sensoria of the third joint in a single row. Beak does not extend beyond the mesocoxæ. Wings frequently clouded, stigma short and concave on the cephalic border. Venation gracefully curved. Legs moderately long. Abdomen hirsute in some species of apterous females. Apical segment with two anal valves. Honey-tubes short. Style knobbed. This genus comprises some of the most beautiful forms of the Aphidinæ.

Genus **Calaphis** Walsh.[17]

Antennæ long, linear, seven-jointed, fourth shorter than the third, fifth shorter than the fourth, six less than one-half as long as fifth, seventh slender and twice as long as the sixth. Prothorax more than one-half as long as the thorax. Honey-tubes moderate. Wings steeply roofed and differing from those of *Aphis* only in the total absence of the fourth or stigmal vein and the usually robust discoidal veins.

Genus **Cryptosiphum** Buckston.[17]

Vertex convex. Antennæ very short in the apterous, but longer in the winged form; seventh joint one and one-half times the length of the sixth. Beak extends to the mesocoxæ. Wings short, rounded, and venation normal. Legs rather short. Honey-tubes absent or rudimentary. Style small but distinct in the winged form.

Genus **Monellia** Oestlund.[17]

Antennæ longer than the body, on no frontal tubercles. Beak very short. Thorax low and flat; prothorax nearly as large as the thorax proper. Wings held horizontal in repose; venation as in *Callipterus*. Honey-tubes not obvious. Style short, enlarged at the apex. In general the insects are small and delicate, of a pale color and strongly depressed body.

16. This is an exception to the rule of not counting the unguis or seventh joint when shorter than the sixth joint.

17. No representative in this text.

Genus **Drepanosiphum** Koch.

Antennæ longer than the body and fixed on frontal tubercles; setaceous seventh joint as long or longer than the third, latter with a single row of rather large sensoria. Eyes bright red. Beak short; penultimate joint long in proportion. Wings long and narrow; marginal cell elongated towards the apex of the wing. Discoidals nearly parallel to each other. Honey-tubes moderately long, enlarged near the base. Style inconspicuous or none.

Chaitophorus. Plate VII, fig. 43.

Head black. Antennæ hirsute, dark, darkest on the distal half; length of segments: I, 0.05 mm.; II, 0.03 mm.; III, 0.16 mm.; IV, 0.12 mm.; V, 0.1 mm.; VI, 0.07 mm.; VII, 0.25 mm.; total length about 0.80 mm., extending a little beyond the thorax. Sensoria circular and not equal in size. There are about twelve on the third joint, sometimes one on the fourth, two on the fifth, and eight small and one large one on the distal end of the sixth. Eyes red, ocular tubercles prominent, and ocelli normal. Beak pale yellow, 0.23 mm. long, its extent being midway between the pro- and mesocoxæ.

Prothorax black, its lateral tubercles not very conspicuous. Thorax black; wings pellucid, veins light brown. Stigma dark brown, 0.14 mm. broad and 0.54 long. Total wing expansion, 4.35 mm. Legs dark, hirsute with longer hairs than are shown in the illustration.

Abdomen and the rest of the body armed with long hairs which are mounted on small pale yellow tubercles. Terga colored with transverse black bands which frequently become confluent on the median line. Black spots laterad of these are on each margin of the terga. Honey-tubes black, imbricated, and about as long as broad. Style black, armed with long hairs. It is distinctly knobbed and equal to the honey-tubes in length, being 0.50 mm. Total length of the body, 1.37 mm.

This form was taken May 25, on the willow (*Salix glaucophylla*). It is gregarious in habit and colonizes the leaves. These aphids were apparently exterminated here three times last year, by the ladybird beetles, in a certain willow grove which was nearly submerged by water for a period of nearly a week. The gradual rise of water drowned or drove the aphids to the tops of the trees. Here they fell an easy prey to the

bugs which had previously increased, and all were apparently exterminated by the latter. Then the bugs soon disappeared, presumably for want of food material. Soon the aphids appeared again as numerous as at first. Later the bugs reappeared and the aphids disappeared. This alternation happened three times during the summer.

Among the honey-dew feeders was noticed a Tenthridenid, which obtained the juice as the ant ordinarily does, that is, by attracting the aphids' attention with its antennæ.

Chaitophorus negundinus THOMAS. Plate X, fig. 58.

Head brownish and hirsute. Antennæ dusky except at the bases where they are paler, also very hirsute; length of joints: I, 0.09 mm.; II, 0.072 mm.; III, 0.43 mm.; IV, 0.27 mm.; V, 0.21 mm.; VI, 0.11 mm.; VII, 0.21 mm.; total length, 1.39 mm. Sensoria large, circular; five to ten on the third segment, none on the fourth, one near distal end of the fifth, about five or six small and one large one at the distal end of the sixth. Eyes in young pinkish red and in the adult black. Ocelli three in number and prominent; ocular tubercle prominent. Beak, 0.63 mm. long, extending to second coxa; it is dark at the tip, the remainder is pale yellow.

Prothorax greenish and hirsute. Thoracic sclerites dark, insertions light green. Wings hyaline, veins smoky black, discoidals narrow. Stigma smoky, varying from a light to a dark color; 0.16 mm. broad by 1.28 mm. long. Total wing expansion, 7.24 mm. Legs hirsute, slightly dark at distal ends of articulations. Stout and heavy in proportion to the body.

Abdomen pale green. Honey-tubes darker than the abdomen, 0.09 mm. long, and broader at the bases than in the center. Length of body, 2.35 mm.

This form is gregarious on the box-elder (*Negundo aceroides*). Its colonies sometimes completely cover all the growing parts of the tree. The tree, after being infested in this way, soon becomes coated with a honey-like secretion which seals the breathing pores of the leaves and the aphid is forced to leave for the want of food. After the aphid emigrates the tree puts out new foliage and resumes its growth, if attacked early in the season. This happened here in April, during which time the viviparous winged forms were plentiful.

Chaitophorus populicola Fitch. Plate VII, fig. 42.

Head black. Antennæ black and very hirsute; length of segments: I, 0.01 mm.; II, 0.09 mm.; III, 0.45 mm.; IV, 0.27 mm.; V, 0.19 mm.; VI, 0.09 mm.; VII, 0.21 mm.; total length, 1.37 mm., extending nearly to the central part of abdomen. Sensoria circular; about forty on the third segment, about twenty on the fourth, fifteen on the fifth, and a large one closely connected with about five small ones at the distal end of the sixth. Eyes black; ocular tubercles present but not conspicuous. Beak dark, extending to the mesocoxæ, being 0.63 mm. long.

Prothorax and thorax black. Wings smoky, veins black, robust. Stigma dark, 0.63 mm. long by 0.18 mm. broad. Total wing expansion, 5.76 mm. Legs of good size, black and hairy.

Abdomen greenish black, nearly always marked with black transverse bars, also with a marginal row of black patches. Honey-tubes greenish black, 0.09 mm. long, nearly one-half the tarsi in length. Style almost obsolete, hirsute, distal half black, about 0.07 mm. in length, or nearly as long as the honey-tubes. Body all hirsute, and 2.54 mm. long.

This form was taken on the leaves of the cottonwood (*Populus monilifera*), October 12. Being gregarious in habit, it colonizes both sides of the leaves. The colonies, which live through the summer, are closely guarded by ants, which protect them from their insect enemies. It was a large black species of ant which protected the forms taken and described. About one ant would have charge of a single leaf, and would fight until killed or thrown away from his flock. This aphid was common here during the summer months.

Chaitophorus stevensis, n. sp. Plate VII, fig. 47.

Head black. Antennæ dark, distal half black, all hirsute; length of segments: I, 0.128 mm.; II, 0.07 mm.; III, 0.41 mm.; IV, 0.3 mm.; V, 0.25 mm.; VI, 0.09 mm.; VII, 0.1 mm.; total length, 1.17 mm., extending to near the center of the abdomen. Sensoria circular; fifteen to twenty on the third segment, none on the fourth, the usual one near the distal end of the fifth, and a cluster of ten or twelve at the distal end of the sixth. Eyes black, ocular tubercles prominent and tinged

with red. Ocelli present. Beak black, 0.45 mm. long, extending midway between the pro- and mesocoxæ.

Prothorax dark, thorax black. Wings hyaline, venation slender and of a dark brown color. Stigma, 0.65 mm. long by 0.16 mm. broad. Total wing expansion, 6.00 mm. Legs hirsute, femora, tarsi and distal part of tibia black, remainder yellowish.

Abdomen greenish yellow, hirsute, bordered laterally with eight black spots, and on the dorsal surface are eight black transverse bars. Honey-tubes black, 0.14 mm. long, or about equal to the tarsi in length. They are also incrassate and imbricated. Style hirsute, knobbed, the latter black, base greenish yellow, 0.09 mm. long, or about one-half the length of the honey-tubes. Total length of the body, 2.18 mm.

This form was taken July 9 in a cottonwood gall, and is named in honor of my professor in botany, W. C. Stevens.

Following is the description of the gall as given by Mr. Burrows:[18] "This gall occurs on the ventral side of the leaf of the cottonwood (*Populus monilifera*) in early summer. The gall is an elongated, semielliptical swelling of the midrib near the center of the leaf; 10 mm. in length and 5 mm. in height; green in color when young but of a straw color during maturity; walls thin, firm, and succulent. The gall has a mouth-like opening on the dorsal side of the leaf, which remains slightly open. This orifice runs parallel with the midrib nearly the length of the gall. The leaf folds dorsally along the midrib, enclosing the orifice of the gall. The young lice are found both in the gall with the stem-mother and outside clustered around the opening, being protected there by the fold of the leaf. The lice are protected with a white powder-like excrescence. These galls are not common in this region. I am under the impression that, owing to the early disappearance of this gall, only one brood of gall-producing stem-mothers exist during the summer, which brood, without doubt, comes from the impregnated egg. The subsequent broods do not have the power of producing galls."

Chaitophorus flabellus, n. sp. Plate XX, fig. 95.

Head dark and cone-shaped, as shown in the illustration. Antennæ black, except the basal half of the third joint, which

18. Burrows's unpublished manuscript.

is light brown; length of joints: I, 0.10 mm.; II, 0.07 mm.; III, 0.45 mm.; IV, 0.21 mm.; V, 0.21 mm.; VI, 0.12 mm.; VII, 0.23 mm.; total length, 1.59 mm., being about equal to the body in length. Sensoria circular and few, usual distal one present on the fifth, one equal to this in size on the distal end of the sixth, and a smaller one at the basal part of the seventh. Eyes black, ocular tubercles and ocelli absent. Beak dark and short, 0.18 mm. long, extending to the mesocoxæ.

Prothorax not plainly set apart from the head. Thorax has no distinct lobes, but has two patches of dark coloration on the dorsal part, as shown in the illustration. Legs slightly hirsute; also there are from a few to eight flabellæ on each one; femora dark, tarsi dark, tibia light brown. Legs all normal in length. Femora especially well developed, the cephalic pair the largest.

Abdomen dark brown, with black coloration in the region stippled in the drawing. Whole body sparsely covered with flabellæ. Honey-tubes black, imbricated as wide at the base as long, tuberculate, 0.09 mm. long, or a little more than half the length of the tarsi. Style black, knobbed, mounted with five or six setaceous hairs, which are on prominent tubercles. Length, 0.09 mm., being equal to the honey-tubes in length. Total length of the body, 1.50 mm.

This form was taken May 4, from grass sweepings; consequently its host-plant and habits are not exactly known. Since only one was taken, and the coloration of it not well noted, the description may not be exact.

Callipterus genevei, n. sp. Plate VII, fig. 45.

Head pale yellow. Antennæ dusky, imbricated, and almost bare; length of segments: I, 0.05 mm.; II, 0.05 mm.; III, 0.46 mm.; IV, 0.34 mm.; V, 0.28 mm.; VI, 0.18 mm.; VII, 0.19 mm.; total length, 3.60 mm., or nearly equal to the body in length. Sensoria circular; ten to twelve on the third joint, none on the fourth, the usual distal one on the fifth, one surrounded with a fringe of fine hairs at the distal end of the sixth. Eyes red; ocular tubercles prominent; ocelli normal. Beak dark at the distal end, remainder pale yellow. Length, 0 27 mm., extending to the mesocoxæ.

Prothorax pale yellow; thorax of the same color. Wings hyaline, veins dark and bordered with a light smoky color,

wider on each side than the veins. Stigmal vein obsolete at the base. Stigma, 0.12 mm. broad and 0.45 mm. long. Total wing expansion, 4.89 mm. Legs brownish yellow, hirsute, and normal in length.

Abdomen brown, with black markings situated at the base of capitate hairs, which are on small tubercles, as shown in the figure. Honey-tubes are concolorous with the abdomen, widest at their bases, and 0.07 mm. long, or about half the length of the tarsi. Style knobbed with a large elongate knob, hirsute, having some long, conspicuous hairs, as shown in the figure; a characteristic tubercle is near the distal end mounted with a single hair. Length, 0.23 mm., or about three times the length of the honey-tubes. Total length of the body, 3.84 mm.

This form was taken on the wing, May 18; consequently its habitat was not noted. This species is named in honor of Miss Geneva Hunter.

Callipterus asclepiadis Monell. Plate IX, fig. 56.

This insect has not been described by me before the coloration faded; consequently I cannot give the coloration as when collected. The entire body seems to be greenish yellow. Antennæ nearly bare; length of segments: I, 0.07 mm.; II, 0.05 mm.; III, 0.25 mm.; IV, 0.19 mm.; V, 0.21 mm.; VI, 0.12 mm.; VII, 0.28 mm.; total length, 1.17 mm., extending to the base of the honey-tubes. Sensoria circular; about eight on the third joint, none on the fourth, the usual distal one on the fifth, one large with some small ones on the distal end of the sixth. Eyes black; ocular tubercles prominent; ocelli present but not conspicuous. Beak 0.45 mm. long, extending about two-thirds of the way from the pro- to the mesocoxæ.

Prothorax short with moderate-sized tubercles. Thorax well developed. Wings brownish; some irregular markings were present when collected but have now faded away. Veins frail. Stigma, 0.14 mm. wide and 0.63 mm. long. Total wing expansion, 6.00 mm. Legs hirsute, normal in length.

Abdomen normal in appearance; honey-tubes, 0.19 mm. long, or about twice the length of the tarsi, incrassate, widest near the base. Style concolorous, slightly hirsute, knobbed, 0.12 mm. long, or a little more than half the length of the honey-tubes. Total length of the body, 1.45 mm.

This form was taken November 1, on the milkweed (*Asclepiadis* sp.?). It is gregarious in habit and colonizes the ventral side of the leaves.

Callipterus bellus WALSH. Plate VII, fig. 44.

Head yellowish brown, and very small in proportion to the prothorax, being somewhat overlapped by the latter, making the head appear about twice as broad as long. Antennæ nearly bare, pale, with distal parts of segments three to six black; length of segments: I, 0.09 mm.; II, 0.05 mm.; III, 0.59 mm.; IV, 0.43 mm.; V, 0.41 mm.; VI, 0.23 mm.; VII, 0.36 mm.; total length of antennæ, 2 mm., extending near to the base of the style. Sensoria circular and few, about five on the third joint; the usual one on the fifth near the distal end; a small elongate cluster at the union of the sixth and seventh. Eyes pale red; ocular tubercles present and small. Ocelli present and inconspicuous. Beak dark, extending to the procoxæ, being 0.32 mm. long.

Prothorax extra large. Central part of the same color as the head, but the lateral borders black, which color extends caudad and apparently to the distal end of the wings. Lateral tubercles small, and on the boundary of the pro- and mesothorax. Thorax black; wings hyaline, but black along the costal and subcostal areas, extending to the apex of the wing as shown in the illustration. Discoidals frail and dark brown. Stigma, 0.9 mm. long and 0.14 mm. broad. Total wing expansion, 7.25 mm. Legs black and hirsute, especially the tibia.

Abdomen brownish, anal lobes quite prominent and hirsute, extending midway on the knob of the style. Honey-tubes cylindrical, concolorous with the abdomen, 0.05 mm. long, or about one-third the length of tarsi. Style concolorous with the abdomen, hirsute and spinous, knobbed, 0.32 mm., being six times the length of the honey-tubes, or twice the length of the tarsi. Total length of the body, 2.44 mm.

This form was taken June 14 on the oak (*Quercus rubra*). It is sporadic in habit. Only a few specimens were on the ventral side of each leaf where found.

Callipterus, n. sp. Plate XIV, fig. 76.

Head brownish yellow. Antennæ slightly hirsute, black at the distal ends, except the first, second and seventh joints;

length of joints: I, 0.07 mm.; II, 0.07 mm.; III, 0.63 mm.; IV, 0.36 mm.; V, 0.34 mm.; VI, 0.18 mm.; VII, 0.14 mm.; total length, 1.80 mm., or about equal in length to the body. Sensoria circular and rather large but indistinct; about seven to the third joint, not close together, absent on the fourth joint, the usual one near the distal end of the fifth joint, and about four small and one large at the base of the unguis. Eyes red; ocelli red. Beak concolorous with the head, reaching to the mesocoxæ, 0.27 mm. long.

Prothorax brownish yellow, small in proportion to the head. Thorax brownish yellow. Wings hyaline, veins slender, light brown and curving, each ending in a brownish splotch, cubitus obsolete at the base. Stigma light brown, 0.45 mm. long and 0.109 mm. wide; total wing expansion, 0.90 mm. Legs rather long in proportion to the body, tibia slightly hirsute, all concolorous with the body.

Abdomen brownish yellow. Honey-tubes as long as wide at the base, being 0.05 mm. long, or half the length of the tarsi. Style knobbed, concolorous with the abdomen, hirsute, and 0.128 mm. long, being nearly twice as long as the honey-tubes; anal lobes prominent. Entire length of the body, 1.72 mm.

This form was taken in July, on the elm (*Ulmus americana*). It is somewhat gregarious, but not very noticeable. Mostly found on the ventral side of the leaves.

Callipterus sp.? Plate VII, fig. 32.

Head dark green. Antennæ slightly hirsute; distal end of the third, fourth, fifth and sixth dark, remainder concolorous or lighter than the head; length of segments: I, 0.09 mm.; II, 0.09 mm.; III, 0.52 mm.; IV, 0.45 mm.; V, 0.36 mm.; VI, 0.14 mm.; VII, 0.10 mm.; total length, 1.75 mm., extending nearly to the base of the honey-tubes. Sensoria circular; five or six on the third joint, none on the fourth, the usual distal one on the fifth, and a distal one about the same size on the sixth; the usual group of smaller ones seem to be absent in this case. Eyes black; ocular tubercles prominent; ocelli present but not conspicuous. Beak dusky, 0.45 mm. long, extending to a point midway between the pro- and mesocoxæ.

Prothorax dusky, caudal half with several small tubercles, about twenty; some of the smaller ones on the lateral sides are

mounted with a single spinous hair. Thorax bluish green; wings pellucid and smoky; veins black margined with black, smoky borders one-half to two-thirds as wide as the stigma. Stigma concolorous with the vein borders; 0.19 mm. broad and 0.72 mm. long. Sometimes the costal cell is also colored with the same coloration as the stigma. Total wing expansion, 6.52 mm. Legs dark green or brown, which is not uniform throughout their length; the distal end of the hind tibia being the lightest in color. All hirsute and normal in length except the hind tibia, which is long.

Abdomen bluish green, somewhat hirsute, but not armed with hairs as is the apterous form. Instead of the spines are small tubercles. Dorsal part of the abdomen marked with about seven dark transverse bars. Each lateral margin has the same color in the form of spots. Honey-tubes dusky, clavate, with wide-open mouths. Length, 0.09 mm., equal to the style in length, but not half as long as the tarsi. Style globular, hirsute, light in color, 0.09 mm. long. Equal in length to the tarsi. Anal lobes prominent, hirsute, a little larger than the knob of the style. Total length of the body, 2.08 mm. This form was taken on the elm (*Ulmus americana*). The winged forms appeared about May 20. It is gregarious in habit and colonizes the ventral side of the leaves. A variation of this species is shown on plate VII, figure 46.

Tribe APHIDINI.

Antennæ moderately long, hardly ever longer than the body. Frontal tubercles rarely present, and very conspicuous when present. Seven-jointed (except in *Mastopoda*). Eyes with ocular tubercles. Beak moderately long. Legs moderately long and well developed. Abdomen never very long, compact, and somewhat rounded caudally. Honey-tubes generally cylindrical or slightly incrassate, rarely tuberculate or obsolete. Style conical, generally well developed, rarely obsolete. This tribe is gregarious, and is found on the leaves, tender stems, and, in rare cases, on the roots of plants.

Genus **Hyalopterus** Koch.[19]

Vertex flat. Antennæ about as long as the body. Sensoria small and irregularly placed. Eyes dark red. Beak short.

19. No representative in text.

Wing hyaline, long, with slender veins. Legs moderately long. Honey-tubes short, cylindrical, narrow, not longer than the style. Latter small, pointed, and curved upwards.

Genus **Mastopoda** Oestlund.[19]

Antennæ as long as the body, six-jointed, the third and setaceous sixth being the longest, on no frontal tubercles. Eyes dark red. Beak moderately long. Wings rather short and broad, deflexed in repose; venation typical. Legs rather long, with the tarsi and claws atrophied. The tibiæ are truncate at the tip and furnished with a membrane, the structure of which seems to be similar to that of Diptera, as they are able to walk with ease not only on the perpendicular but also on the under surface of a glass plate. The upper side of the tibial tip is furnished with a small tubercle, which probably represents the claws.

Genus **Sipha** Passerini.

This genus resembles *Aphis*, with the exceptions of having longer wings (see figure) in proportion to the body, and shorter antennæ, being but six-jointed and extending but little beyond the thorax.

Genus **Aphis** Linn.

Antennæ usually a little longer than the body. Frontal tubercles none or very rudimentary. Eyes red or black. Beak variable in length. Wings rather short and broad, deflexed in repose, venation typical. Legs moderately long. Abdomen short and broad, rounded or obtuse behind. Honey-tubes of moderate length, cylindrical or sometimes slightly incrassate, very rarely obsolete. Style short, thick, conical, and usually prominent.

Genus **Siphocoryne** Passerini.[19]

Antennæ on no frontal tubercles, and shorter than the body; third joint with many sensoria, which causes it to appear serrate on the ventral side; seventh joint not longer than the third. Beak short to moderately long. Wings rather short and broad, deflexed in repose. Legs moderately long. Honey-tubes moderately long but sometimes extending a little caudad

of the distal end of the style. Style in our species apparently short but in British species long.

Genus **Rhopalosiphum** Koch.

Vertex flat or slightly convex. Antennæ about as long or longer than the body, on remote small and inconspicuous frontal tubercles. Beak generally moderately long, but variable in length. Prothorax with no lateral tubercle. Wings moderately long, venation normal. Legs short and robust. Honey-tubes incrassate, or clavate. Style conspicuous, variable in size, sometimes small and slender, but often large.

Sipha rubifolii Thomas. Plate VIII, fig. 50.

Head black; antennæ light brown, imbricated. Length of segments: I, 0.05 mm.; II, 0.05 mm.; III, 0.308 mm.; IV, 0.09 mm.; V, 0.128 mm.; VI, 0.19 mm.; total length, about 0.9 mm., extending about the length of the style beyond the abdomen. Sensoria circular, rather large; number on the third joint, two to six in a row, one at the distal end of the fourth, six small and one large at the distal end of the fifth. Eyes black; ocular tubercles of a reddish tinge. Ocelli prominent. Beak dark brown, 0.36 mm. in length, and extends a little beyond the mesocoxæ.

Prothorax dark brown, cephalic border black; thorax black; wings hyaline, veins light brown and frail. Stigma very light brown, 0.54 mm. long and 0.18 mm. broad. Total wing expansion, 3.96 mm. Legs light brown, slightly hirsute; tarsi and femora a little darker than the tibia, which is very long in proportion to the remainder of the leg.

Abdomen light brown; honey-tubes imbricated, concolorous to the abdomen, almost cylindrical, and 0.145 mm. long. Style concolorous with the abdomen, conical, hirsute, and 0.09 mm. long, being about a third the length of the honey-tubes. Average length of the body, 0.90 mm.

This form was taken May 7, at Girard, on the cultivated blackberry (*Rubus villosus?*). It is gregarious on the ventral side of the leaves.

In Thomas's description of this aphis,[20] he did not have enough material to thoroughly satisfy his curiosity, it seems. Particu-

20. Thomas, Rept. Ent. Ill., 8: 121, 122, 1880.

larly the wing venation was not clear to him. On account of abundance of material, I can say that his statements were all true, except the third discoidal of the cubitus in his specimen must have been slightly abnormal. I think that the elimination of one joint in the antennæ is brought about by the non-division of the third and fourth, because in all aphids that I have examined the winged form has a constant distal sensorium on the fifth segment. In this form this is present on the fourth, which, together with the arrangement of the sensoria on the distal end of the fifth, which corresponds to the normal arrangement of the sixth segment in the genus *Aphis*, furnishes proof that the fourth and fifth joints of this form correspond to the fifth and sixth in *Aphis*. Furthermore, I have an example of the gradual elimination of one joint by the coalition of the third and fourth. It is shown in plate XXII, figure 100, and described as a transitional form.

Drepanosiphum acerifolii THOMAS. **Plate XX, fig. 94.**

Head brownish yellow. Antennæ paler than the head, except the distal end of the third, both ends of the fourth, fifth, sixth, and the base of the seventh, which are all black; all slightly hirsute; length of joints: I, 0.21 mm.; II, 0.05 mm.; III, 0.86 mm.; IV, 0.59 mm.; V, 0.55 mm.; VI, 0.13 mm.; VII, 0.90 mm.; total length, about 3.17 mm. (These measurements are not constant.) Sensoria circular; of the third, eight to eleven, somewhat large, raised and in a single row, mostly on the basal half of the segment. The usual large sensoria present near the distal end of the fifth joint. Three large sensoria in a longitudinal row near the distal end of the sixth joint. Eyes red; ocular tubercles present. Ocelli prominent, with a dark border. Beak dark, 0.36 mm. long, and extending nearly to the mesocoxæ.

Prothorax as wide as the head, pale black. Thorax brownish yellow, sclerites sometimes with dark longitudinal centers. Wings hyaline in places, venation frail, greenish yellow; stigma somewhat mottled, ranging from a clear color to a dark brown; in length, 0.59 mm., and breadth, 0.21 mm. All the veins have a smoky border as shown in the illustration. Total wing expansion, 4.70 mm. Legs pilose, pale brown, and small in proportion to the body.

Abdomen brownish yellow, honey-tubes dark, incrassate, and somewhat funnel-shaped at the end; length, 0.25 mm. Style concolorous with the abdomen, hirsute, knobbed, and 0.07 mm. long.

This form was taken on the Soft maple (*Acer dasycarpum*), during the middle of May. They endured weather which froze off the ends of their antennæ. They are both sporadic and gregarious in habit, and may be found on the terminal buds, but more frequently on the ventral side of the leaves.

Aphis ribis, n. sp. Plate XVI, fig. 82.

Head dark. Antennæ dark, much imbricated, and with but few hairs; length of segments: I, 0.05 mm.; II, 0.07 mm.; III, 0.27 mm.; IV, 0.23 mm.; V, 0.19 mm.; VI, 0.12 mm.; VII, 0.28 mm.; total length, 1.30 mm., extending to the central part of the abdomen. Sensoria circular, six in a row on the third joint, four in a row on the fourth, the usual distal one on the fifth, six small and one large one at the distal end of the sixth. Eyes black; ocular tubercles prominent; ocelli normal. Beak dusky, 0.41 mm. long, extending midway between the pro- and mesocoxæ.

Prothorax dark, lateral tubercles broader than long. Thorax dark, wings pellucid; veins with a very slight smoky border. Stigma black, 0.63 mm. long and 0.13 mm. broad. Total wing expansion, 3.02 mm. Legs of a nearly uniform brown, tibia lighter except the distal end.

Abdomen dark green, with four pairs of lateral black spots. Near the caudal end on each side the style is a lateral tubercle about twice as long as broad. Honey-tubes black, with imbrications like those on the antennæ, cylindrical, and 0.19 mm. long, being twice the tarsi in length and extending to near the base of the style. Style conical; distal half black, the color extending to the base along the lateral margins. The enclosed part is of a lighter color. Armed with numerous small spines and some setaceous hairs. Length, 0.18 mm., or about equal to the honey-tubes. Total length of the body, 2.37 mm.

This form was taken May 17, on the cultivated currant (*Ribes rubrum*, var. *subglandulosum*). It is gregarious in habit and colonizes the ventral side of the leaves, causing them to curl, which forms a pseudogall of protection.

Aphis rumicis Linn. Plate XI, fig. 67.

Head black. Antennæ dark, imbricated, and nearly bare; length of segments: I, 0.07 mm.; II, 0.07 mm.; III, 0.37 mm.; IV, 0.23 mm.; V, 0.21 mm.; VI, 0.12 mm.; VII, 0.23 mm.; total length, 1.30 mm., extending to the central part of the abdomen. Sensoria circular and unequal in size; eight to ten on the third joint, none on the fourth, the usual distal one on the fifth, and one large one at the distal end of the sixth. Eyes black; ocular tubercles prominent; ocelli not very conspicuous. Beak dark, 0.54 mm. long, extending to the mesacoxæ.

Prothorax brown, narrow in length and slightly overlapped by the thorax, which partly hides the lateral tubercles. The thorax is black and arched. Wings pellucid, discoidals black, costal and subcostal dark brown, the latter bordered caudad with a light brown line. Stigma dark, 0.16 mm. broad and 0.66 mm. long; total wing expansion, 6.88 mm. Legs dark brown, hirsute, and normal in length.

Abdomen dark; honey-tubes black, imbricated, cylindrical, and 0.14 mm. long, being equal to the tarsi in length. Style black, hirsute, and 0.16 mm. long, being but little longer than the honey-tubes. Total length of the body, 1.90 mm.

This form was taken May 5, on dock (*Rumex crispus*). It is gregarious and colonizes the terminal stems. The colony gives the parts a black appearance, on account of their proximity to each other.

Aphis, n. sp. Plate XIV, fig. 75.

Head black. Antennæ black with but few hairs, and imbricated; length: I, 0.05 mm.; II, 0.05 mm.; III, 0.25 mm.; IV, 0.18 mm.; V, 0.16 mm.; VI, 0.10 mm.; VII, 0.19 mm.; total length, 0.99 mm., extending to the mesocoxæ. Sensoria circular, unequal in size, and numerous, sixteen to thirty on the third joint, eight to ten on the fourth, the usual distal one and sometimes two or three others on the fifth; a cluster of small ones and a large one at the distal end of the sixth. Eyes black; ocelli conspicuous, bordered with black; ocular tubercles prominent. Beak dark, 0.45 mm. long, extending half-way to the mesocoxæ.

Prothorax dark, lateral tubercles prominent, and as broad as long. Thorax black. Wings subhyaline, veins medium

sized and dark. Stigma dark brown, 0.10 mm. wide and 0.34 mm. long. Total wing expansion, 5.80 mm. Legs hirsute and normal. Tarsi, distal ends of tibia and femora dark, rest lighter in color.

Abdomen dark green; lateral tubercles at the base of the abdomen not as large as those on the prothorax. There are two of these, one on each side of the abdomen. Honey-tubes black, imbricated, cylindrical; length, 0.19 mm., or about one-fifth of their length longer than the tarsi, extending nearly to the base of the style. Latter black at its distal half, the color extending to the base along the margins, remainder concolorous with the abdomen; slightly hirsute and armed with short spines. Length, 0.18 mm., or nearly to the honey-tubes in length. Total length of the body, 1.81 mm.

This form was taken April 25, on the wild gooseberry (*Ribes gracile*). It is gregarious and colonizes the ventral side of the leaves, causing them to curl. It is similar to the form that is found on the terminal stems, but has more sensoria, lateral tubercles are not as conspicuous on the abdomen, and no color marks here, as the other form has.

Aphis aubletia, n. sp. Plate XII, fig. 68.

Head black. Antennæ dusky, imbricated, and bare; length of segments: I, 0.05 mm.; II, 0.05 mm.; III, 0.21 mm.; IV, 0.128 mm.; V, 0.14 mm.; VI, 0.128 mm.; VII, 0.22 mm.; total length, 0.90 mm., extending one-third its length caudad of the abdomen. Sensoria rather large, circular, and nearly in rows; seven on the third joint, three on the fourth, two on the fifth, and one large one with a cluster of small ones at the distal end of the sixth. Eyes black; ocular tubercles have a reddish tinge; ocelli not very prominent, bordered with a reddish tinge. Beak light brown, extending to the metacoxæ, being 0.54 mm. long.

Prothorax dusky, cephalic border black. Thorax black, membrane dusky. Wings stippled with irregular dark spots, which gives them a dark cast. All veins robust, and all equal in breadth except the subcostal, which is broader. Second discoidal of the hind wing sometimes forked, as shown in the illustration. Total wing expansion, 4.30 mm. Legs stout, hirsute, and pale brown; tarsi and distal end of the tibia dusky.

Abdomen light brown in some species, dusky in others. Honey-tubes concolorous with the abdomen, cylindrical, and 0.21 mm. long, or twice the length of the tarsi. Style black on distal half, hirsute, and 0.128 mm. long, or half the length of the honey-tubes. Total length of the body, 1.31 mm.

This form was taken in May, on the verbena (*V. aubletia*). It is gregarious and colonizes all the above-ground plant.

Aphis, n. sp. Plate IX, fig. 52.

Head black. Antennæ black, bare, and imbricated; length of segments: I, 0.07 mm.; II, 0.07 mm.; III, 0.28 mm.; IV, 0.18 mm.; V, 0.18 mm.; VI, 0.09 mm.; VII, 0.34 mm.; total length, 2.15 mm., extending a third of the way caudad on the abdomen. Sensoria circular and unequal in size; twenty to twenty-five on the third joint, three in a row on the fourth, the usual one near the distal end of the fifth, six small and unequal in size and one large at the distal end of the sixth. Eyes black; ocular tubercles prominent; ocelli conspicuous. Beak dark, 0.72 mm. long, the distal end of the second joint reaching the abdomen.

Prothorax dark; lateral tubercles prominent; thorax dark; wings pellucid, venation medium in width, and dark. Stigma dark, 0.14 mm. broad and 0.54 mm. long. Total wing expansion, 6.80 mm. Legs a little long in proportion to the body. Tarsi, distal end of the tibia and femora black, remainder lighter in color.

Abdomen brownish green, a black spot on the lateral margin of each tergum, also two black transverse bars caudad the honey-tubes. Six lateral tubercles on each lateral margin. The first one at the base of the abdomen and the one caudad the honey-tube as large as the lateral tubercle on the prothorax, remainder smaller in size. Honey-tubes black, imbricated, almost cylindrical, broadest at the base; the distal end has a very narrow expanding rim. Caudad these is a black patch on each side of the abdomen. Cephalad each is a semicircular light band extending caudad the base. Length, 0.25 mm., or twice the length of the tarsi, extending to the base of the style. Style black at the distal half, this color extends cephalad along the margins, remainder concolorous with the abdomen. All hirsute and armed with short spines. Length, 0.18 mm., or a

little more than half the length of the honey-tubes. Total length of the body, 1.99 mm.

This form was taken July 12, on the dorsal side of the tenderest leaves of burdock (*Arctium lappa*). It is gregarious in habit, but not very numerous. Its colonization of the burdock lasted only a short time this last summer.

Aphis, n. sp. Plate X, fig. 57.

Head black. Antennæ dark, imbricated, and bare; length of segments: I, 0.03 mm.; II, 0.05 mm.; III, 0.25 mm.; IV, 0.18 mm.; V, 0.12 mm.; VI, 0.10 mm.; VII, 0.37 mm.; total length, 1.25 mm., or about the length of the seventh joint shorter than the body. Sensoria circular, giving the antennæ an uneven appearance; about thirty on the third, ten on the fourth, the usual distal one on the fifth, and one equal to this in size at the distal end of the sixth, with four or five smaller ones. Eyes black, with a purple tinge; ocular tubercles prominent; ocelli prominent. Beak dark, 0.36 mm. long, extending midway between the pro- and mesacoxæ.

Prothorax short and dark. Thorax black and well developed. Wings subhyaline, venation dark, discoidals quite straight. Stigma not as dark as the veins, 0.54 mm. long and 0.12 mm. broad. Total wing expansion, 5.12 mm. Legs slightly hirsute; tarsi, distal part of the tibia, and all but the proximal part of the femora black.

Abdomen dark green. Honey-tubes black, incrassate, extending a little caudad the base of the style, 0.13 mm. long, being a little longer than the style or tarsi. Style grayish in color, having a few long setaceous hairs, and armed with small spines. Length, 0.19 mm., or about equal to the tarsi in length. Total length of the body, 1.63 mm.

This form was taken June 6, on the honeysuckle (*Lonicera sempervirens* (?)). It is gregarious in habit and colonizes the ventral side of the leaves. The colonies have not been very prosperous here while this collecting has been done.

Aphis, n. sp. Plate XII, fig. 71.

Head black. Antennæ black, imbricated, bare with the exception of a few spinous hairs; length of segments: I, 0.05 mm.; II, 0.05 mm.; III, 0.25 mm.; IV, 0.18 mm.; V, 0.16 mm.; VI, 0.10 mm.; VII, 0.29 mm.; total length, 1.10 mm.,

extending a little beyond the thorax. Sensoria circular, nearly uniform in size; from eight to ten on the third joint, situated nearly in a straight row, about four in a row on the fourth, the usual one near the distal end of the fifth, and a cluster of seven not uniform in size on the distal end of the sixth. Eyes black; ocular tubercles not prominent; ocelli normal. Beak dark, extending to the mesocoxæ, being 0.54 mm. long.

Prothorax dark, cephalic margin black, lateral tubercles broader than long. Thorax black, membrane pale brown. Wings nearly hyaline, veins black, bordered with a very light smoky tinge, which is about twice as broad as the veins. Stigma light brown, 0.12 mm. broad and 0.68 mm. long. Total wing expansion, 6.80 mm. Legs hirsute, articulations dark, except the coxal ones, which are pale yellow.

Abdomen brownish green, with about four black spots along the lateral margins, also the distal segment ventrad the style is black. One lateral tubercle on each side the first abdominal segment, and one on each side the abdominal segment caudad the honey-tubes. Honey-tubes cylindrical, black, imbricated, and 0.18 mm. long. Style black and hirsute, equal to the honey-tubes in length, or 0.18 mm. Total length of the body, 1.80 mm.

This form was taken April 21, on the wild gooseberry (*Ribes* sp.?). It is gregarious, colonizing the petioles and tender growing stems of the plant. The young apterous forms are green, thus being protected by coloration with the host-plant; yet they are not entirely exempt from parasitic enemies on this account, for whole colonies are often exterminated by them in a few days after being attacked.

Aphis nerii Fonsc. Plate VIII, fig. 48.

Head black. Antennæ yellowish black, bare, and imbricated; length of segments: I, 0.07 mm.; II, 0.05 mm.; III, 0.28 mm.; IV, 0.19 mm.; V, 0.19 mm.; VI, 0.10 mm.; VII, 0.27 mm.; total length, 1.05 mm., extending to the abdomen. Sensoria circular, large and unequal in size; about nine on the third joint, none on the fourth, the usual distal one on the fifth, six small and one large one at the distal end of the sixth. Eyes black; ocular tubercles reddish; ocelli normal. Beak dark, 0.39 mm. long, extending to the mesocoxæ.

Prothorax dark yellow; lateral tubercles present but not very prominent. Thorax dark yellow; wings pellucid, veins dark brown bordered with a faint smokiness. Stigma dark, 0.07 mm. in breadth and 0.12 mm. long. Total wing expansion, 5.80 mm. Tarsi and distal end of the tibia black, remainder brownish yellow. All slightly hirsute and normal in length.

Abdomen brown, with a marginal row of three or four black spots, one at the base of each honey-tube, and some transverse markings along the median line, as shown in the illustration. Honey-tubes imbricated, cylindrical, and black, except a small semicircular patch at the cephalic part of the base which is of a light yellow. Length, 0.19 mm., or about twice as long as the tarsi. Style hirsute and imbricated. It has a black distal half, the color extending along the margin to its base; the remainder is light yellow in color. It is 0.10 mm. long, or about one-half the length of the honey-tubes. Total length of the body, 2.00 mm.

This form was taken November 1, on the milkweed (*Asclepias* ——) and oleander (*Nerium oleander*). It is gregarious and colonizes the ventral side of the leaves. Fitch has named this louse *asclepiadis*, but it is doubtless the same form which Fonslecomb named *nerii*. (Thomas, Rept. Ent. Ill., 8 : 95, 1880.) For a variation in form, see plate IX, figure 72.

Aphis sambucifolia Fitch. Plate XIX, fig. 91.

Head black. Antennæ brownish black and hirsute; length of segments: I, 0.09 mm.; II, 0.09 mm.; III, 0.34 mm.; IV, 0.23 mm.; V, 0.23 mm.; VI, 0.12 mm.; VII, 0.39 mm.; total length, 1.50 mm., extending to the abdomen. Sensoria circular and numerous; about twenty-six on the third segment, twelve on the fourth, six on the fifth, and a cluster of very small ones mounted with short hairs at the distal end of the sixth. Eyes black with a slight tinge of red; ocular tubercles prominent; ocelli normal. Beak blackish at the distal end, 0.9 mm. long, extending to the mesocoxæ.

Prothorax is black and short, having two pairs of lateral tubercles, the caudal pair not conspicuous; the cephalic pair broader than long. Thorax is black and arched. Wings pellucid with a brownish cast; veins dark brown with narrow smoky borders. Stigma, 0.72 mm. long and 0.09 mm. wide.

Total wing expansion, 6.70 mm. Prothoracic legs light brown, femora and tarsi of mesa- and metathoracic legs black, tibiæ light brown.

Abdomen slightly hirsute, grayish, with about eight indistinct transverse black bars, and a black patch at the base of each honey-tube. Along the lateral margin are eight lateral tubercles. The honey-tubes are black, slightly clavate, and 0.36 mm. long, or about three times the length of the tarsi. Style hirsute, all black except a small semicircle at the base, 0.11 mm. long, or about one-third as long as the honey-tubes. It is bluntly rounded distally.

This form was taken June 15. It is gregarious in its habits, colonizing the terminal leaves of the elder (*S. canadensis*). It is similar in its work to the *Chaitophorus negundinis*, in that it is attended by ants and secretes so much honeydew that the growth of the plant is finally checked for a time. It has previously been considered that the *A. sambuci* Linn. and the *A. sambucifolia* Fitch were synonymous, but with this form and that of figure 60 at hand, a difference is apparent.

Aphis cratægifolia Fitch. Plate XIII, fig. 74.

Head black. Antennæ black, slightly hirsute, first joint glabrous; length of joints: I, 0.036 mm.; II, 0.05 mm.; III, 0.27 mm.; IV, 0.16 mm.; V, 0.145 mm.; VI, 0.17 mm.; VII, 0.31 mm.; total length, 1.04 mm., extending near to the center of the abdomen. Sensoria circular and moderately small; about fifteen on the third joint, seven nearly in a row on the fourth, one small near the center and one large near the distal end of the fifth, and a cluster of four or five at the distal end of the sixth. Eyes dark red; ocular tubercles of a lighter red, and equal in size to the lateral tubercles. Distal half of the second segment of the beak black, remainder brownish yellow. It extends to the mesocoxæ, being 0.45 mm. long.

Prothorax brownish black; sclerites of the thorax black, membrane dusky. Wings hyaline, veins slender and slightly dusky. Subcostal and first discoidal slightly dusky until near the base of the stigma, where subcostal becomes more dusky, especially along the caudal margin to the distal end of the stigma. The latter is dusky gray, 0.67 mm. long and 0.127 mm. wide. In many specimens the cubitus is only once

branched, and, where twice branched, quite near the distal end of the vein, as shown in the illustration; total expansion, 5.80 mm. Legs black except at the proximal ends, which are lighter in color. Coxæ are black.

Abdomen mostly dusky green; two transverse dark bands on the first two segments cephalad the honey-tubes. Also three or four dark patches along the margins cephalad the honey-tubes. Latter dark, incrassate, constricted near the apex, expanding again at apex to the original diameter, being 0.18 mm. long. Style hirsute, dark except at the base, which is concolorous with the abdomen, about 0.10 mm. long, or equal to tarsi or half the honey-tubes in length. Entire body, 1.45 mm. long.

This form is found on the hawthorn (*Cratægus tomentosa*). It hatches from the egg March 15, is gregarious in habit and quite numerous, colonizing both sides of the leaves. The dorsal side was affected in July and greatly corrugated, but in October the form was more sporadic on the ventral side of the leaves.

Aphis brassicæ Linn. Plate X, fig. 61.

Head blackish. Antennæ dark, imbricated, and slightly hirsute; joint I, 0.05 mm.; II, 0.07 mm.; III, 0.70 mm.; IV, 0.28 mm.; V, 0.32 mm.; VI, 0.14 mm., and joint VII, 0.54 mm. long. Total length, 2.10 mm., extending twice the length of the honey-tubes beyond the abdomen. Sensoria of third joint circular, of moderate size, irregularly placed, and about fifty in number. One sensoria near distal end of fifth joint. Six small and one large sensorium on sixth joint at the union of the seventh. Total length of antennæ, 1.81 mm. Eyes black. Ocelli prominent. Beak darker at the distal end than near the base; it extends to the second coxa and is 0.36 mm. long.

The prothorax is dark, especially along the margins. Thorax is black. Wings are hyaline, venation brownish, with a border of a smoky tinge, also rather coarse except stigmal vein, which is also clearer in color. Stigma is dark brown, 0.90 mm. long and 0.16 mm. broad. Total wing expansion, 11.60 mm. Legs dark brown, lightest at the proximal part of the femur. Metathoracic legs smaller than the others.

Abdomen greenish gray, and pulverulent. When this pul-

verulency is removed the aphis is of a greener appearance; also a marginal row of black spots, of which there are four on each side, are more distinct. Extending across the abdomen are about seven or eight dark transverse bars. The honey-tubes are dark, incrassate, and 0.10 mm. long, not extending to the base of the style. The style is dark, hirsute, acute, and 0.12 mm. long by 0.12 mm. wide at the base. Total length of the body, 1.90 mm.

This species was taken from hotbed cabbage, April 23. Later in the season it was found on a great many other plants of the same genus. It is gregarious, and colonizes both sides of the leaves and the tenderest parts of the remainder of the plant.

Aphis cardui Linn. Plate XVI, fig. 83.

Head brownish black. Antennæ black; length of segments: I, 0 mm; II, 0 mm; III, 0.56 mm.; IV, 0.38 mm.; V, 0.23 mm.; VI, 0.12 mm.; VII, 0.48 mm. About twenty-four circular sensoria on the third joint. Eyes dark, tinged with red. Beak, 0.97 mm. long, extending to the caudal boundaries of the mesocoxæ.

Prothorax short, brownish yellow, with a cephalic black border. Thoracic sclerites mostly black, with membrane brownish yellow. Wings hyaline, veins frail; stigma, 0.64 mm. long and 0.16 mm. broad; total wing expansion, 6.48 mm. Legs: Distal half of femora dark brown, becoming paler near the proximal end; tibia dark brown at the distal end and paler proximally; tarsus dark brown.

Abdomen varies in color with the age. Normally there is a dark quadrate patch on the dorsum in the region of the honey-tubes. There are also about three dark patches on the lateral margins of the abdomen; the segments caudad of the honey-tubes have transverse black bands. Honey-tubes black, clavate, and 0.34 mm. long. Style has distal half and lateral borders black, remainder brownish yellow; total length, 0.14 mm., being as broad at the base as it is long. Total length of body, 2.22 mm.

This form was taken June 8. It is gregarious on the common thistle (*Cardus lanceolatus*). The colony shows a variegated appearance in color. The young are quite green and the old are nearly black.

Aphis vitis Scopoli. Plate XI, fig. 65.

Head dark brown. Antennæ black except at the distal ends of the third, fourth, fifth and sixth segments, which are lighter in color; nearly bare and deeply imbricated; length of segments: I, 0.09 mm.; II, 0.07 mm.; III, 0.34 mm.; IV, 0.23 mm.; V, 0.22 mm.; VI, 0.10 mm.; VII, 0.36 mm.; total length, 1.40 mm., generally extending to the distal end of the abdomen. Sensoria circular, six in a row on the third joint, four in a row on the fourth, the usual one near the distal end of the fifth, six small of uniform size and two large ones at the distal end of the sixth. Eyes black; ocular tubercles prominent; ocelli present but not very conspicuous. Beak black, 0.45 mm. long, extending to the mesocoxæ.

Prothorax dark brown; lateral tubercles prominent. Thorax dark brown to black; wings pellucid; veins brownish, rather frail. Stigma black, 0.72 mm. long and 0.14 mm. broad. Total wing expansion, 5.35 mm. Legs normal, black, very slightly hirsute; central part of the tibia a little the lightest in color.

Abdomen dark brown; honey-tubes black, imbricated, and cylindrical; length, 0.32 mm., or about five times the length of the tarsi, extending generally to the tip of the style. Style black, hirsute, conical, and 0.10 mm. long; equal in length to the tarsi, or about one-fifth the length of the honey-tubes.

This form was taken July 9, on the cultivated grape. It is gregarious, and colonizes the tender growing stems and the dorsal side of the leaf.

Aphis gossypii Glov. Plate XII, fig. 69.

Head and antennæ black; latter distinctly imbricated and almost bare; length of segments: I, 0.05 mm.; II, 0.05 mm.; III, 0.19 mm.; IV, 0.14 mm.; V, 0.14 mm.; VI, 0.09 mm.; VII, 0.23 mm.; total length, 0.80 mm., extending to the honey-tubes. Sensoria circular, four or five on the third joint, none on the fourth, the usual distal one on the fifth, and six of unequal size on the distal end of the sixth. Eyes black; ocular tubercles normal; ocelli normal. Beak dark, the distal segment the darkest; length, 0.63 mm. It extends to the abdomen.

The cephalad part of the prothorax is black. The caudal half is pale brown, with the exception of two black spots near

the lateral tubercles. The latter are normal. Thorax black; wings nearly hyaline, veins dark brown and frail. Stigma, 0.09 mm. broad and 0.45 mm. long. Total wing expansion, 4.02 mm.

Abdomen pale brown; one lateral tubercle near the thorax; four black spots along the margin of the abdomen not shown in the illustration. Apical segment also black. Honey-tubes imbricated, nearly cylindrical, being a little wider at the base than at the distal end; 0.18 mm. long, or twice the length of the tarsi. Style black, hirsute, bluntly rounded at the tip; length, 0.10 mm., or a little more than half the length of the honey-tubes. Total length of the body, 1.28 mm.

This form was taken May 23, on the primrose (*Œnothera biennis*). It is gregarious in habit and colonizes the terminal growing parts of the plant. In Aphid. Minn., p. 62, 1887, Oestlund names this species *œnotheræ*, but it seems to be identical with *gossypii* Glov.

Aphis vernonia THOMAS Plate XXII, fig. 100.

Head black. Antennæ light gray, imbricated, and almost naked; length of segments: I, 0.03 mm.; II, 0.05 mm.; III, 0.16 mm.; IV, 0.07 mm.; V, 0.09 mm.; VI, 0.09 mm.; VII, 0.16 mm.; total length, 0.70 mm., which extends a little beyond the thorax, or about two-thirds the length of the body. Sensoria circular, four to eight on the third joint, sometimes one near the central part of the fourth joint, the usual one present near the distal end of the fifth, and a cluster of about five which border a larger one at the distal end of the sixth joint. Eyes red; ocular tubercles prominent; ocelli normal and conspicuous. Beak dark, 0 50 mm. long, extending to the central part of the abdomen in some specimens, in others not quite as far, but most always extending as far as do the antennæ.

Prothorax light brown, except the cephalic margin, which is black; lateral tubercles well developed and prominent. Thoracic sclerites black, membrane lighter in color. Wings nearly hyaline, veins dark. Stigma brownish black, 0.09 mm. broad and 0.45 mm. long. Total wing expansion, 3.70 mm. Legs nearly uniform in color, being pale yellow; tibia and tarsi a shade lighter and slightly hirsute.

Abdomen pale brown, with two tubercles caudad the honey-tubes about the size of the lateral tubercles. Honey-tubes cylin-

drical and imbricated, 0.25 mm. long, or about twice the length of the tarsi. Style concolorous with the abdomen, hirsute, also armed with short spines. It is bluntly rounded at the distal end and 0.09 mm. long, or a little less than one-half the length of the honey-tubes. Total length of the body, 1.18 mm.

This form was taken July 9, on ironweed (*Vernonia baldwini*). It is gregarious, and colonizes the tender terminal growing parts. This form is similar to the genus *Sipha* in size, shape, and especially in the construction of the third and fourth antennal joints, inasmuch as they are not as distinctly divided as is common in the genus *Aphis*, but appear as a gradation between the two genera.

Aphis. Plate V, fig. 35.

Head black. Antennæ dark, imbricated, and almost naked; length of segments: I, 0.09 mm.; II, 0.05 mm.; III, 0.36 mm.; IV, 0.23 mm.; V, 0.18 mm.; VI, 0.09 mm.; VII, 0.34 mm.; total length, 1.30 mm., or extending to near the center of the abdomen. Sensoria circular, fifteen to twenty on the third joint, ten to twelve on the fourth, usually two or three on the fifth, and a cluster of four or five at the distal end of the sixth. Eyes black; ocular tubercles prominent, tinged with red; ocelli normal. Beak dark, 0.54 mm. long, extending midway between the pro- and mesocoxæ.

Prothorax black, lateral tubercles prominent. Thorax black; wings hyaline, veins brown. Stigma light brown, 0.18 mm. broad and 1.07 mm. long. Total wing expansion, 7.70 mm. Legs hirsute, dark except the tibia, which are a shade lighter.

Abdomen blackish. Honey-tubes black, clavate, being dilated at the distal ends; length, 0.18 mm., being two and one-half times the length of the tarsi. Style black, hirsute, bluntly rounded at the tip and turned dorsad; 0.09 mm. in length, or one-half the length of the honey-tubes. Total length of the body, 1.90 mm.

This form was taken April 25, on waahoo (*Euonymus atropurpureus*). It is gregarious in habit, and colonizes the leaves.

Aphis maidis Fitch. Plate XI, fig. 66.

Head black. Antennæ black, with few scattered hairs; length of segments: I, 0.07 mm.; II, 0.07 mm.; III, 0.34 mm.; IV, 0.19 mm.; V, 0.16 mm.; VI, 0.10 mm.; VII, 0.14

mm.; total length, 1.10 mm., distal end of the sixth joint extending to the abdomen. Sensoria circular, about eighteen or twenty on the third, four on the fourth, sometimes in a row, three or four on the fifth, six small with one large at the distal end of the sixth. Eyes black; ocular tubercles prominent; ocelli present, frontal one conspicuous, others not very conspicuous. Beak dark, 0.35 mm. long, extending to the mesathorax.

Prothorax black, lateral tubercles small and conspicuous. Thorax black; wings subhyaline, veins rather frail. Stigma black, 0.16 mm. broad and 0.99 mm. long. Total wing expansion, 7.68 mm. Legs black, slightly hirsute.

Abdomen bluish green, with five black spots on each lateral margin, also three black but not very distinct transverse bars caudad the honey-tubes. One lateral tubercle on each margin of the basal tergum; one on each of the two first terga caudad the honey-tubes. These tubercles are all about equal to the prothoracic tubercles in size. Honey-tubes black, imbricated, slightly dilated in the middle and expanded at the rim. Each is located in a black patch. At the cephalic base of each tube is a small semicircular brownish patch. Length, 0.16 mm., not extending to the base of the style, and but little longer than the style. Latter black on the distal half, with the color extending cephalad along the margin to the base. Cephalic half in this margin concolorous with the abdomen. Armed with few hairs and numerous small spines. The distal end is turned dorsad. Length, 0.12 mm., being half the length of the tarsi. Total length of the body, 2.35 mm.

This form was taken September 4, on cultivated corn (*Zea mays*). It is gregarious, and attacks the corn in practically the same manner as the chinch-bug. It is most numerous on the distal joint of the stalk, being protected by the sheath of the last leaf.

Aphis cerasifoliæ Fitch. Plate X, fig. 59.

Description from an apterous, viviparous form.

Head black. Antennæ black except the third and sometimes the fourth joint, which is of a light color; all slightly hirsute; length of segments: I, 0.09 mm.; II, 0.07 mm.; III, 0.39 mm.; IV, 0.23 mm.; V, 0.23 mm.; VI, 0.09 mm.; VII, 0.54 mm.; to-

tal length, 1.45 mm., extending to the central part of the abdomen. Sensoria few and circular; the usual distal one on the fifth, and the cluster of six or seven at the distal end of the sixth. Eyes black; ocular tubercles prominent; ocelli absent, or if present not conspicuous. Beak black, 0.28 mm. long, extending to the abdomen.

Prothorax black; has conspicuous lateral tubercles. Thorax black. Legs all black except the proximal two-thirds of the tibia, which is of a light color.

Abdomen black. Honey-tubes black, incrassate, thickest near the base and tapering toward the distal end, where they sometimes dilate into an imperfect knob; length, 0.27 mm., being about three times the length of the tarsum. Style light-colored, hirsute, and 0.18 mm. long, or two-thirds the length of the honey-tubes. Total length of the body, 1.99 mm.; width at the thorax, 0.90 mm.

This form was taken May 7, on the cultivated plum (*Prunus* sp. ?). It is gregarious and colonizes the leaves, sometimes corrugating them.

Aphis sambuci Linn. Plate X, fig. 60.

Head black. Antennæ black, slightly hirsute; length of segments: I, 0.07 mm.; II, 0.07 mm.; III, 0.25 mm.; IV, 0.23 mm.; V, 0.18 mm.; VI, 0.12 mm.; VII, 0.34 mm.; total length, 1.23 mm., extending to the honey-tubes. Sensoria circular, unequal in size, and twenty to twenty-five on the third joint, from one to five on the fourth, about three on the fifth, seven small and one large at the distal end of the sixth. Eyes black; ocular tubercles prominent; ocelli normal. Beak black, discoidals bounded caudad with a narrow dark line. Stigma dark, 0.14 mm. broad and 0.54 mm. long. Total wing expansion, 6.72 mm. Tarsi, distal part of the tibia and femora black; remainder brown.

Abdomen slate-colored. Honey-tubes black, imbricated, cylindrical, and dilated at the distal end, forming a flat rim; length, 0.37 mm., or about four and one-half times the length of the tarsum. Style black, bluntly rounded at the end, hirsute, and armed with small spines. Length, 0.12 mm., or about one-third the length of the honey-tubes.

This form was taken June 15, on the elder (*Sambucus cana-*

densis). It is gregarious and colonizes the terminal twigs, often killing them with its secretions, which choke the stomata of the leaves. There seem to be two varieties of this aphis on the same host-plant.

A form has been described by Fitch which colonizes the ventral side of the leaves of the elder, but since I have found two forms on the same plant, it is difficult to tell which is meant from his meager description to be *sambucifoliæ*. However, I shall give this form Linn's determination, and the other form, shown on plate XIX, figure 91, Fitch's determination. Thomas supposed the two names to be synonymous, but he had neither of the species at hand from which to determine the proof of his statement.

Syphocryne avenæ Fabr. Plate VIII, fig. 49.

Head dark. Antennæ light brown, and hirsute; length of segments: I, 0.05 mm.; II, 0.07 mm.; III, 0.07 mm.; IV, 0.23 mm.; V, 0.21 mm.; VI, 0.09 mm.; VII, 0.29 mm.; total length, 1.21 mm. Sensoria of the third about eight, sometimes in a single row; none on the fourth; on the fifth the usual one near the distal end; six small ones around a large one near the unguis of the sixth. Eyes black; ocular tubercles tinged with red; ocelli present but not prominent. Beak concolorous and extending to the third coxa, being 0.72 mm. long.

Prothorax light brown, with a dark cephalic border. The lateral tubercles are quite conspicuous, although the prothorax is short. Thorax dark brown. Wings slightly brownish, veins light brown. Stigma of a lighter brown, 0.14 mm. wide and 0.61 mm. long. Total expansion of wings, 4.89 mm. Legs light brown, except the articulations, which are darker; all rather finely hirsute. Metathoracic legs are long in proportion to the others.

Abdomen brown, lateral margins somewhat tuberculate; four or five black spots on each lateral margin. Honey-tubes black, imbricated, and cylindrical; the distal ends have narrow, expanding rims; length, 0.27 mm. Style black and spinous, except the proximal part, which is concolorous with the abdomen, and the lateral boundaries, which are concolorous with the distal end.

This form was taken April 16, on the apple tree. It is gregarious, and colonizes the terminal buds and tender stems, also

both sides of the leaves. This brood hatches from the eggs which have been deposited in the leaf-scales of the buds and the crevices of the bark the previous fall. The young lice are predominantly green.

Aphis sp.? Plate XI, fig. 62.

Head black. Antennæ black, with but few hairs; length of joints: I, 0.09 mm.; II, 0.07 mm.; III, 0.54 mm.; IV, 0.37 mm.; V, 0.28 mm.; VI, 0.14 mm.; VII, 0.63 mm.; total length, 2.12 mm., being about the length of the honey-tubes longer than the body. Sensoria circular, between forty and fifty on the third joint, between fifteen and twenty on the fourth, about ten on the fifth, the distal one being about three times greater in diameter than the others; six small and one large at the distal end of the sixth. Eyes black; ocular tubercles small and not very prominent; ocelli present but not very conspicuous. Beak dark, 0.45 mm. long, extending to the mesocoxæ.

Prothorax dark, cephalic border black; thorax black; wings subhyaline, veins black, very robust, and margined with a very faint smoky border not wider than the vein itself. Stigma black, 0.14 mm. broad and 0.72 mm. long. Total wing expansion, 6.40 mm. Legs all black except the proximal part, which is sometimes brownish.

Abdomen dark green, with four black spots on each lateral margin. Honey-tubes black, incrassate, distal two-thirds dilated, 0.34 mm. long, being a little longer than twice the tarsi in length, extending nearly to the distal end of the style. The latter is black with a few long, spreading hairs; also armed with numerous small spines. Length, 0.14 mm., equal to the tarsum in length. Total length of the body, 1.99 mm.

This form was taken October 12, on the cultivated raspberry (*Rubus occidentalis*). It seems to be somewhat sporadic in habit, since only a few were found at the time. Earlier in the season a colony was found on the terminal stems of the wild raspberry, but none were collected on account of their sudden disappearance, due to a hard wind- and rain-storm.

Aphis sp. Koch. Plate XIV, fig. 77.

Head dark. Antennæ a shade lighter in color, imbricated, and almost bare; length of segments: I, 0.07 mm.; II, 0.05

mm.; III, 0.45 mm.; IV, 0.28 mm.; V, 0.28 mm.; VI, 0.10 mm.; VII, 0.50 mm.; total length, 1.78 mm., being about the length of the tarsum longer than the body. Sensoria circular and unequal in size; there are fifteen or twenty on the third segment, five to eight in a row on the fourth, five or six on the fifth, and a cluster of about six unequal in size on the distal end of the sixth. Eyes black; ocular tubercles inconspicuous; ocelli inconspicuous. Beak dark, 0.45 mm. in length, extending to the abdomen.

Thorax of a mild black; wings lightly pellucid, veins dark and frail. The subcostal is bounded caudad with a faint light band. The stigma is dark and 0.09 mm. broad by 0.45 mm. long. Total wing expansion, 4.00 mm. Legs black, a shade lighter at the bases, slightly hirsute, and normal in length.

Abdomen pale yellow, with about seven black patches located as shown in the illustration, and four or five lateral black spots. These patches are variable in size and number. Honey-tubes are black, imbricated, and cylindrical, with a slight dilation at the base; 0.19 mm. in length, or about one and one-half times the length of the tarsi. Style black, except a small basal part; hirsute, spinous, ensiform, and 0.09 mm. long, being half the length of the honey-tubes. Total length of the body, 1.28 mm.

This form was taken November 1, on the cultivated strawberry (*Fragaria virginiana*). It is somewhat sporadic, but forms small colonies on the dorsal side of the leaves. The apterous forms have more pronounced frontal tubercles than the winged forms.

Aphis gossypii Glov. Plate XI, fig. 64.

Head black. Antennæ dark, latter imbricated, and almost bare; length of segments: I, 0.07 mm.; II, 0.05 mm.; III, 0.27 mm.; IV, 0.18 mm.; V, 0.16 mm.; VI, 0.09 mm.; VII, 0.27 mm.; total length, 1.37 mm., or about the length of the third joint shorter than the body. Sensoria circular and large; there are from eight to ten on the third joint, none on the fourth, the usual distal one on the fifth, and about six small ones of unequal size at the distal end of the sixth. Eyes are black; ocular tubercles prominent; ocelli normal. The beak is dark, 0.50 mm. long, and extends to the mesacoxæ.

Prothorax dark, lateral tubercles prominent and conspicuous.

Thorax dark. Wings nearly hyaline, being slightly pellucid, veins frail and dark; stigma dark gray, 0.10 mm. wide and 0.54 mm. long; total wing expansion, 4.68 mm. Legs black on the distal half of the femora; distal part of the tibia, and the tarsum dark brown, remainder pale brown. Legs are normal in proportion.

Abdomen pale brown, with four black spots on each lateral margin; two transverse dark bars caudad the honey-tubes; mesocaudad the honey-tubes and bordering their bases are two larger patches of the same color. The portion ventrad the style is also dark. The honey-tubes are black, imbricated, and almost cylindrical, being a little wider at the base than at the distal end; length, 0.18 mm., being nearly twice the length of the tarsum. Style black, hirsute, bristled, and bluntly rounded at the apex; 0.10 mm. long, being equal to the tarsum in length.

This form was taken January 3, on the greenhouse *Hibiscus*. It seems to be common in greenhouses during the winter. Being gregarious, it colonizes the dorsal surface of the leaves.

Rhopalosiphum violæ Pergande. Plate XV, fig. 78.

Head black. Antennæ black, hirsute, first joint glabrous; length of joints: I, 0.109 mm.; II, 0.07 mm.; III, 0.48 mm.; IV, 0.34 mm.; V, 0.36 mm.; VI, 0.14 mm.; VII, 0.56 mm.; total length, 2.00 mm. Sensoria circular, moderately small, and numerous, being about thirty-six on the third joint; on the fourth are eleven, nearly in a straight row; the usual one is near the distal end of the fifth; one large one and a cluster near it of six small ones near the distal end of the sixth. Eyes pinkish red; ocular tubercles well developed and of a lighter tinge than the eyes. Beak grayish and extending to the mesocoxæ, being 0.45 mm. long.

Prothorax grayish black with membrane of pinkish yellow. Dorsum of the thorax black with a membrane of pinkish yellow. Wings hyaline; discoidals all black with broad, fainter black borders; all very characteristic. Stigma grayish black, 0.47 mm. long by 0.129 mm. wide; total wing expansion, 4.89 mm. Femora of legs black, except the proximal parts, which are pinkish yellow. The tibia are dark yellow, with the distal parts the darkest. Tarsi are a shade lighter and hirsute.

Abdomen is pinkish yellow with about four black splotches

on the lateral margins. There are two black transverse bars caudad of the honey-tubes and six cephalad. Three or four of the latter are sometimes continuous, forming a quadrate patch irregular in outline. The honey-tubes are dark gray, incrassate, and 0.27 mm. long. The style is concolorous with the abdomen, cone-shaped, and 0.09 mm. long.

This aphid is gregarious on greenhouse violets and colonizes mostly the ventral side of the leaves. Some will feign death when disturbed and fall from the leaves; others will remain with a firmer grasp than ever.

Rhopalosiphum rois MONELL. Plate XIII, fig. 73.

Head brown. Antennæ dark and slightly hirsute; length of segments: I, 0.07 mm.; II, 0.07 mm.; III, 0.50 mm.; IV, 0.43 mm.; V, 0.34 mm.; VI, 0.16 mm.; VII, 0.54 mm.; total length, about 2.08 mm., or about the length of the honey-tube longer than the body. Sensoria circular; six to twelve on the third joint, in a row; none on the fourth; the usual one near the distal end of the fifth; about five small and one large one at the distal end of the sixth. Eyes black; ocular tubercles prominent; ocelli conspicuous. Beak black, 0.45 mm. long, and extending midway between the pro- and mesocoxæ.

Thorax all dark brown. Wings hyaline, veins black; first discoidal bordered with a narrow margin of a dark brown about as wide as the vein itself; second discoidal bordered in the same manner but fainter. The subcostal is also bordered with the same on its caudal margin. The stigma is dark brown, 0.12 mm. wide and 0.72 mm. long. Total wing expansion, 7.12 mm. Legs all dark, hirsute, and long in proportion to the body.

Abdomen light brown. Honey-tubes dark, dilated more distally than proximally; they are 0.39 mm. long, or twice the length of the tarsi. Style dark, hirsute, and conical, 0.18 mm. long, or one-half the length of the honey-tubes. Total length of the body, 1.81 mm.

This form was taken June 27, on sumac (*Rhus glabra*). It is gregarious and colonizes the tender stems, petioles, and the ventral side of the leaves. The individuals remain quite near each other while on this host-plant, and have a remarkably good protective coloration.

Rhopalosiphum dianthi SCHRANK. Plate IX, fig. 55.

Head black. Antennæ black, with a few hairs; length of segments: I, 0.09 mm.; II, 0.07 mm.; III, 0.45 mm.; IV, 0.37 mm.; V, 0.30 mm.; VI, 0.12 mm.; VII, 0.41 mm.; total length of antennæ, about 1.81 mm., or about the length of the fifth segment longer than the body. Sensoria circular; ten to twelve on the third joint, none on the fourth, the usual distal one on the fifth, and about seven of unequal size at the distal end of the sixth. Eyes red; ocular tubercles prominent and red; ocelli prominent. Beak black, 0.36 mm. long, extending to the mesocoxæ.

Prothorax black; thorax black. Wings hyaline, veins frail and dark brown in color. Stigma and costal veins light brown. Stigma, 0.10 mm. broad and 0.77 mm. long. Total wing expansion, 6.52 mm. Distal half of femora black; distal end of the tibia and the tarsi black; all slightly hirsute. Legs all long in proportion to the body.

Abdomen pale green, with black markings on the dorsal surface. In old specimens these black splotches frequently become confluent, forming an irregular dark area, as shown in the illustration. Honey-tubes black in old specimens, but slightly pale at the base in younger ones. They are incrassate, being enlarged on the distal half more than is shown in the illustration. Length, 0.36 mm., or about one and a half times the length of the tarsum. Style black, hirsute, and spinous, somewhat curved in the center, so that the distal end is turned dorsad. Length, 0.18 mm., or half the length of the honey-tubes. Total length of the body, 1.80 mm.

This form was taken April 25, on the pansy (*Viola tricolor?*) It seems to be a greenhouse form, since the plants affected were transplanted from hotbeds to open air, which served as hosts for the innumerable form which colonized all parts of them, beginning on the ventral side of the leaves.

Genus **Macrosiphum** PASSERINI [21]

Front grooved. Antennæ filiform, nearly always longer than the body, and on distinct and approximate frontal tubercles.

21. This genus has had a profuse confusion of names. Following are some of Theo. Pergande's conclusions on the subject, which seem to be final: "In accordance with priority, the generic term *Siphonophora*, as adopted by Koch, had already been preoccupied by Eschscholtz and described by him in 'Syst. d. Acaleph,' in 1829, though, without knowing this fact, it was again applied by Brandt (Bull. Acad. St. Petersburg) in 1836, for a genus belonging to the Myriopoda. Oestlund, recognizing the preoccupation of *Siphonophora*, substituted for it (Aphididæ of Minnesota, p. 78, 1887) the name *Nectarophora*, overlooking the fact that *Nectarophora* wa

The two basic joints short and thick; third, fourth and fifth joints long; the third joint long, but not always as long as the setaceous seventh. Beak moderately long. Distal joint about equal to the penultimate. Prothorax in rare instances with a lateral tubercle. Wings large and normally veined. Honey-tubes long, often extending beyond the style, cylindrical, tapering, and nearly always straight. Style long, generally recurved, and ensiform.

Genus **Myzus** Passerini.

Antennæ about equal in length to the body, on moderately distinct frontal tubercles, which are gibbous on the inner side. First joint of the antennæ also gibbous, but not dentate. Wings moderately long, venation normal. Body often with capitate hairs. Legs moderately long and robust. Honey-tubes rather long and cylindrical.

Genus **Nectarosiphum** Oestlund.[22]

Antennæ as long or longer than the body, on moderately large frontal tubercles, but not approximate as in the *Nectarophora*. Prothorax well developed, with a distinct lateral tubercle. Wings rather long and clouded near the apex. Legs long and slender. Honey-tubes very long, much dilated in the middle, and curved. Style long and conspicuous.

Genus **Phorodon** Passerini.

Vertex flat. Antennæ scarcely longer than the body, situated on frontal tubercles, each with a characteristic tooth developed on the inner side. First joint bluntly toothed, or gibbous, which is of much importance, since the frontal tubercles are not significant without this; third joint the longest; fourth and fifth joints nearly equal in length. Beak moderately long, extending to the second coxa. Wings moderately long, with a normal venation.

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antedated by *Macrosiphum* Pass. (Gli Afidi, p. 27, 1860), a generic term unfortunately adopted by Oestlund for a species with long, clavate nectaries, found on *Rubus strigosus*, which he named *Macrosiphum rubicola*, a generic term also adopted by Del Guerico (Afidafauna Italica, pp. 144 and 159) for a number of species agreeing with the characters of *Macrosiphum* Oestlund, overlooking, however, the fact that *Macrosiphum* was preoccupied by Passerini for a genus structurally quite different. Dr. M. H. Schoutenden was the first to observe this error, and changed *Macrosiphum* Oestlund to *Nectarosiphon*, in contradistinction to *Macrosiphum* Passerini."—U. S. Dept. of Agric., Div. Ent., Bull. No. 44, pp. 13 and 14, 1904.

22. No representative in this text.

Myzus cerasi Fab. Plate IX, fig. 54.

Head and antennæ black, latter imbricated. Length of segments: I, 0.10 mm.; II, 0.07 mm.; III, 0.45 mm.; IV, 0.32 mm.; V, 0.25 mm.; VI, 0.10 mm.; VII, 0.41 mm.; total length of antennæ, 1.70 mm., or extending a little farther than to the abdomen. Sensoria circular, about twelve to the third joint, nearly in a row; absent on the fourth, but the usual one present near the distal end of the fifth; a cluster of about six on the distal end of the sixth and the base of the seventh. These vary in size and are each mounted with small, numerous hairs. Eyes black; ocular tubercles prominent, tinged with red; ocelli normal. Beak black, 0.45 mm. long, extending to the mesocoxæ.

Prothorax black; a small elevation marks the location of the absent tubercles. Thorax black. Wings hyaline, venation brownish and slender; stigma, 0.63 mm. long by 0.10 mm. broad. Total wing expansion, 5.90 mm. Legs black, hirsute; color lightest on the tibia to near the distal end.

Abdomen black, short, and broad, which gives it an ovoid appearance. Honey-tubes black, imbricated, and incrassate, being twice as wide at the base as near the distal end; latter funnel-shaped; entire length, 0.41 mm., or about four times the length of the tarsum. Style black, covered with short spines and a few hairs. It is conical in shape, and 0.14 mm. long, being about four times the length of the honey-tubes. Total length of the body, 2.08 mm.

This form was taken June 16, on the cultivated cherry. It is gregarious, colonizing the leaves, and when quite numerous also the tender twigs. They are quite conspicuous, being black on a green plant. In general appearance the wingless, however, are more of a brownish cast. Whole colonies of these have been totally exterminated here in only a few days, supposedly from the action of some parasitic enemy.

Myzus persicæ Sulz. Plate XVI, fig. 81.

Head black. Antennæ black and with but few hairs; length of joints: I, 0.14 mm.; II, 0.09 mm.; III, 0.68 mm.; IV, 0.61 mm.; V, 0.43 mm.; VI, 0.18 mm.; VII, 0.72 mm.; total length, 2.85 mm., extending beyond the abdomen about the length of the honey-tubes. Sensoria circular; twelve to four-

teen on the third, none on the fourth; the usual distal one on the fifth, which is nicely bordered with over-encircling hairs; one similar to that on the fifth, with a bunch of five or six small ones at the distal end of the sixth. Eyes dark red; ocular tubercles prominent; frontal ocellus prominent, dorsal ocelli present but not conspicuous. Beak dark, 0.36 mm. long, extending to the metathorax.

Thorax all black. Wings subhyaline; stigma dark, 0.19 mm. broad and 0.90 mm. long. Total wing expansion 6.52 mm. Legs slightly hirsute, the tibia long in proportion to the body.

Abdomen dark green, with black dorsal markings. Sometimes the transverse bars nearest the honey-tubes are confluent, forming a large irregular patch. In addition to these bars on the terga are black spots on the lateral margins of the same. The honey-tubes are black, incrassate, being enlarged on the distal half; also they have narrow expanded rims; length, 0.48 mm., being a little more than two and one-half times the tarsi in length. Style black, with a few long, spreading hairs and numerous small spines; the tip is turned dorsad; length, 0.21 mm., or a little less than half the length of the honey-tubes. Total length of the body, 1.99 mm.

This form was taken October 12, on the cultivated peach. It colonizes the ventral side of the leaf, but has not been very numerous here.

Myzus prunifoliæ Fitch. Plate IV, fig. 31.

Head dark brown. Antennæ nearly bare, imbricated; first two joints concolorous with the head; basal third of the third nearly white, distal two-thirds dark brown; basal half of the fourth lighter than the dark brown distal half; fifth dark brown except a small basal portion; sixth and basal part of the seventh dark brown, remainder lighter in color. Length of segments: I, 0.09 mm.; II, 0.07 mm.; III, 0.27 mm.; IV, 0.21 mm.; V, 0.19 mm.; VI, 0.09 mm.; VII, 0.88 mm.; total length, 1.80 mm., extending a little caudad the body. Sensoria circular; six or eight on the third joint, none on the fourth, the usual one present on the distal end of the fifth, six small, equal in size and one larger one at the distal end of the sixth. Eyes black; ocular tubercles present but not prominent; ocelli not

conspicuous. Beak light-colored, except the distal end, which is dark; length, 0.45 mm., extending to the mesocoxæ.

Prothorax dark brown, short, and arched. Thorax dark brown and arched slightly. Wings pellucid, veins dark brown. Stigma dark brown, 0.12 mm. broad and 0.54 mm. long; total wing expansion, 5.40 mm. Legs hirsute; tarsi, distal part of the tibia and the distal part of the femora black, remainder light colored. Hind tibia a little long in proportion.

Abdomen dark brown. On each lateral margin are at least three tubercles. Honey-tubes concolorous, cylindrical, and imbricated like the antennæ; length, 0.28 mm., or about one and one-half times the length of the tarsi. Style lighter in color than the body, armed with numerous small spines and about four long, setaceous hairs; length, 0.18 mm., or equal to the tarsi in length. Total length of the body, 1.54 mm.

This form was taken on the cultivated plum, July 9. It is gregarious and colonizes the surface of the leaves, which causes them to curl and form pseudogalls in which the aphids are more or less protected from parasites. Ants were noticed to patronize these colonies and to kill aphis-lions and ladybird beetles which were trying to devour the aphids.

Myzus achyrantes Monell. Plate IX, fig. 53

Head and antennæ nearly black; latter imbricated and almost naked. Length of segments: I, 0.12 mm.; II, 0.07 mm.; III, 0.55 mm.; IV, 0.41 mm.; V, 0.30 mm.; VI, 0.12 mm.; VII, 0.54 mm.; total length, 2.00 mm., or equal to the body in length. Sensoria circular, unequal in size; ten to the third joint, none on the fourth, the usual distal one on the fifth, about five and one large at the distal end of the sixth. Eyes dark red; ocular tubercles prominent; cephalic ocellus prominent, others not very conspicuous. Beak dark, and extends midway between the pro- and mesocoxæ, being 0.45 mm. long.

Thoracic sclerites all black. Wings hyaline, veins black. Stigma, 0.12 mm. broad and 0.81 mm. long. Total wing expansion, 3.60 mm. Distal half of the femur, distal part of tibia and tarsi black, remainder pale brown.

Abdomen has a background of yellowish brown, bordered on the lateral margins with a black spot to each segment, and on the dorsum with two, three or four spots on each of the first

three segments, a transverse black bar between the style and the honey-tubes; also a confluent patch is cephalad the latter. Honey-tubes are incrassate and black, 0.41 mm. long, or three times the length of the tarsum. The style is black, 0.19 mm. long, hirsute, and gradually tapers to a point. It is about equal to the tarsus in length. Total length of the body, 2.04 mm.

This form was taken on the sweet alyssum (*Alyssum maratimum*), *Asparagus plumosa*, willow (*Salix* sp.), and gladiolus. It is gregarious in habit and colonizes the leaves.

Macrosiphum, n. sp. Plate XV, fig. 79.

Head black. Antennæ hirsute, bristly in nature, and of a capitate character. All segments of a mottled black except the base of the third, which is light in color. Length of segments: I, 0.14 mm.; II, 0.07 mm.; III, 0.63 mm.; IV, 0.59 mm.; V, 0.57 mm.; VI, 0.13 mm.; VII, 0.99 mm.; total length of antennæ, 3.00 mm., or twice the length of the body. Sensoria circular, few, and small, being about eight in a row on the third segment, none on the fourth, the usual one near the distal end of the fifth, and a large one with five small ones at the distal end of the sixth. Eyes red; ocular tubercles prominent; ocelli present but not prominent. Beak dark, hirsute distal segment black. Total length, 0.54 mm., extending to the abdomen.

Prothorax brown; thorax black. Wings of a brownish tinge. First discoidal with a very heavy border of dark brown; second discoidal marked with a little less of the same; third discoidal and stigma not bordered, but brown in color. Stigma, 0.63 mm. long by 0.0 mm. broad. The caudal boundary of the stigma is darker than the cephalic boundary. Total wing expansion, 4.94 mm. Legs hirsute, the hairs are short, stiff, and bristly in nature. Tarsi, distal ends of femora and each end of tibia black. Legs all slender in proportion to the body.

Abdomen dark, with scattering, short, somewhat capitate hairs. Honey-tubes imbricated, black, cylindrical, and 0.41 mm. long, being about four times the length of the tarsi. At the base cephalad the honey-tubes is a light-colored crescent. This as well as each honey-tube is situated on a tubercular prominence of the abdomen. Style ensiform, lighter in color than the abdomen, dirty gray. At the distal end is one long, capitate hair; other hairs are present, distributed toward the

base. It is 0.14 mm. long, being about one-third the length of the honey-tubes. Total length of the body, 3.60 mm. Mr. Pergande identifies this as a new species of *Macrosiphum*.

This form was taken July 22, on a plant which was destroyed before it could be identified. The species is gregarious, and colonizes the tender, growing parts of the plant. From the specimens the anomalous features of the wing venation may be seen. On about ninety per cent. of the individuals studied the venation appeared as shown on the slide, where in the remainder a frequent slight third branching of the third discoidal was noticed. In one specimen it was nearly perfect on one wing. Also the appearance of a single discoidal on the caudal wing was noticed in a few specimens, but in none was it perfect. The relative size of the caudal wing is very noticeable. With the exceptions of the abnormalities of the wings, this form appears to be a very good representative of the genus *Macrosiphum*. The apterous forms could without doubt be classified as distinctly of this genus.

Macrosiphum sp.? Plate XIX, fig. 90.

Head and basal joints of the antennæ dark brown. Antennæ black and hirsute; length of segments: I, 0.14 mm.; II, 0.09 mm.; III, 0.82 mm.; IV, 0.80 mm.; V, 0.70 mm.; VI, 0.18 mm.; VII, 1.00 mm.; total length, 3.73 mm., or about twice the length of the body. Sensoria circular, irregular in size and numerous; on the third joint fifty or more, on the fourth twelve, and nearly in a straight row; ten to fifteen on the fifth; a cluster of seven of equal size and a larger one at the distal end of the sixth. Eyes black; ocular tubercles prominent; ocelli normal. Beak dark, 0.80 mm. long, and extends to the mesocoxæ.

Prothorax dark brown, cephalic margin black. Thorax of a darker brown. Wings hyaline, discoidals dark brown, costals light brown. Stigma dark brown, 0.19 mm. broad and 0.90 mm. long. Total wing expansion, 6.52 mm. Legs black, except proximally from the center of the femora, which is yellowish brown.

Abdomen dark brown. Honey-tubes black, imbricated, and 0.45 mm. long, being twice the length of the tarsi. Style hirsute, concolorous with the abdomen, widest near the middle and

0.23 mm. long, being one-half the length of the honey-tubes. Total length of the body, 1.98 mm.

This seems to be a male form, and was taken June 21, on the wing. Data not sufficient for identification.

Macrosiphum, n. sp. Plate XX, fig. 93.

Head dark green. Antennæ black, slightly hirsute; length of segments: I, 0.18 mm.; II, 0.09 mm.; III, 0.86 mm.; IV, 0.12 mm.; V, 0.82 mm.; VI, 0.18 mm.; VII, 1.09 mm.; total length, 3.34 mm., the fifth joint extending to the tip of the abdomen. Sensoria circular, unequal in size; about twenty-five on the third, none on the fourth, the usual distal one on the fifth, six small and one large, the latter equal to the distal fifth, on the distal end of the sixth. Eyes black; ocular tubercles prominent; ocelli present, bordered with black. Beak dark, 0.63 mm. long, extending nearly to the mesocoxæ.

Thorax all dark green. Wings hyaline; the first two discoidals strong, the first bordered with a conspicuous border of black as wide as the vein itself; second also bordered with the same but fainter. The cubitus and stigmal vein not bordered but somewhat frail. Stigma dark gray, black along the caudal margin; length, 1.28 mm.; breadth, 0.18 mm. Total wing expansion, 7.68 mm. Legs long, slightly hirsute; tarsi, tibia and distal half of the femora black, remainder greenish brown.

Abdomen reddish brown. Honey-tubes black, cylindrical, slightly dilated at the distal extremity, 0.73 mm. long, or four and one-half times the length of the tarsi, extending to the distal end of the style; the latter dark green, with a few long hairs and numerous short spines. The distal hair is capitate; length, 0.32 mm., or twice the length of the tarsum. Total length of the body, 2.70 mm.

This form was taken October 25, on the box-elder (*Negundo aceroides*). It is gregarious in habit and colonizes the ventral side of the leaves.

Macrosiphum chrysanthemi Oestlund. Plate XVII, fig. 85.

Head brownish black. Antennæ all dark except base of the third joint which is of a clearer brown. All the joints are hirsute. The I is 0.12 mm. long; II, 0.072 mm.; III, 0.59 mm.; IV, 0.34 mm.; V, 0.32 mm.; VI, 0.109 mm.; VII, 0.54

mm.; total length of antennæ, about 1.88 mm., extending beyond the abdomen. Sensoria of third joint are rather large, circular, irregular, and numerous, varying in number from twenty to thirty; sensoria of fourth about five in a row; of fifth, one near the distal end; of sixth, six small and one large sensorium at union of the seventh segment. Ocelli normal. Beak smoky from near the distal end to near the middle; distal segment narrow and nearly uniform in width; total length, 0.54 mm., reaching to the second coxa.

Prothorax brownish black; cephalic boundary black. Lateral tubercles very small. Thorax dark. Wings hyaline, veins slender, not distinctly colored but of a blackish cast. Third discoidal arising from the proximal part of the stigma, and obsolete at the base. Stigma a little more dense than the rest of the wing and darker in color, 0.63 mm. long and 0.09 mm. wide. Total wing expansion, 5.07 mm. Legs hirsute; distal end of the tibia and the tarsus dark; the proximal end of the tibia and the femur black. All of the appendages seem to be rather long in proportion to the remainder of the insect.

The abdomen is a shade lighter brown than the rest of the body, hirsute, more dense near the caudal part. Honey-tubes black, imbricated, and slightly incrassate, 0.23 mm. long. Style black, hirsute, and somewhat ensiform, 0.27 mm. long. Total length of body, 1.50 to 1.60 mm.

This form was taken May 30, 1903, on the common white chrysanthemum. It is gregarious, and colonizes the terminal buds and the tenderest stems, also the ventral side of the leaves.

Macrosiphum ambrosiæ Thomas. Plate XVIII, fig. 87.

Head light brown. Antennæ dark, hirsute; length of the first joint, 0.09 mm.; II, 0.09 mm.; III, 0.86 mm.; IV, 0.66 mm.; V, 0.60 mm.; VI, 0.14 mm.; VII, 1.28 mm.; total length, 3.08 mm. The sensoria of the third joint are numerous, varying from fifty to sixty; on the fourth joint are about twelve; at the distal end of the fifth is the usual large one; at the distal end of the sixth is one large sensorium surrounded by about three small ones. Eyes black with a tinge of brown. Ocelli normal, three in number. Beak brown, last segment dark, hirsute, 0.86 mm. long, extending to the mesocoxæ.

Prothorax light brown, except the cephalic margin, which is

black. The thorax is dark brown. The wings are hyaline with light brown veins, which in this species are often quite anomalous, *i. e.*, having secondary branches. Stigma light brown, 0.97 mm. long and 0.16 mm. wide. Total wing expansion, 8.96 mm. Legs dark except the basal half of the femur, which is a very light brown. They are also hirsute and long in proportion to the body.

Abdomen brown; honey-tubes black, imbricated, and almost cylindrical, 0.50 mm. long. Style concolorous with the abdomen, ensiform, hirsute, and 0 50 mm. long. Total length of body, 2.70 mm.

This form was taken October 6. It is gregarious, and may be found on the tender parts and ventral sides of the leaves and tender branches of White snakeroot (*Eupatorium ageratoides*) as long as they contain sap. Described from a female specimen. For an illustration of an apterous, viviparous stem-mother, see plate XXII, fig. 99.

Macrosiphum, n. sp. Plate XXI, fig. 97.

Head black. Antennæ black except the base of the third joint, which is slightly pale; length of the antennal segments: I, 0.12 mm.: II, 0.05 mm.; III, 0.77 mm.; IV, 0.55 mm.; V, 0.54 mm.; VI, 0.14 mm.; VII, 0.59 mm.; total length, 3.15 mm. Sensoria of the third joint not distinct but numerous and of moderate size, there being thirty to forty; none on the fourth; a large one near the distal end of the fifth; the usual group present at the distal end of the sixth. Eyes are dark, tinged with red. Ocular tubercles are prominent and bordered with black. Beak dark, reaching to second coxa, and about 0.80 mm. in length.

Prothorax dark, rather narrow, and long. Thorax dark, almost black. Wings hyaline, veins slender and brownish. Stigma yellowish brown, 0.19 mm. broad by 0.90 mm. long. Total wing expansion, 7.92 mm. Legs hirsute and black except the proximal half of the femora.

Abdomen greenish black; honey-tubes black, cylindrical, imbricated, slightly trumpet-shaped at the tip, broader than this at the base, and 0.72 mm. long, extending to the tip of the abdomen. Style pale brown, imbricated, hirsute, broadest in the

center and curved up at the tip, and 0.41 mm. long. Total length of body, 3.36 mm.

This form may be found in greenhouses during the growth of the *Bidens chrysanthemoides*. It is gregarious on this plant, colonizing the tender buds, stems, and leaves. It is also found common in gardens where chrysanthemums are, especially the white varieties.

Macrosiphum erigeronensis THOMAS. Plate XIX, fig 92.

Head black. Antennæ slightly hirsute, dusky except the first two joints and base of the third joint; length of segments: I, 0.01 mm.; II, 0.07 mm.; III, 0.54 mm.; IV, 0.46 mm.; V, 0.36 mm.; VI, 0.14 mm.; VII, 0.64 mm.; total length 2.40 mm., being about equal to the body in length. Sensoria circular, prominent, and numerous; about forty on the third joint, none on the fourth, the usual distal one on the fifth, about six small and one large one at the distal end of the sixth.

Thorax all of a deep, shiny green. Lateral tubercles present in the apterous form but not conspicuous in the winged form. Wings hyaline, veins dark; discoidals frail. Stigma, 0.12 mm. broad and 0.54 mm. long. Total wing expansion, 5.80 mm. Proximal part of the femora yellowish brown, remainder of legs black, slightly hirsute, and nearly normal in size.

Abdomen of a shade lighter green than the thorax. Honey-tubes dark, imbricated, and almost cylindrical, being widest at the base; length, 0.45 mm., or about three times the length of the tarsi. Style dark green, slightly hirsute, armed with short spines, ensiform, and 0.27 mm. long, or half the length of the honey-tubes.

This form was taken October 19, on fleabane (*Erigeron canadensis*). It is gregarious in habit and colonizes the tender, growing parts.

Macrosiphum sp. Plate XVII, fig. 86.

Head and antennæ brownish black. Antennæ with a few spreading hairs; length of segments: I, 0.12 mm.; II, 0.09 mm.; III, 0.77 mm; IV, 0.70 mm.; V, 0.63 mm.; VI, 0.18 mm.; VII, 1.19 mm.; total length, 3.58 mm., or nearly twice as long as the body. Sensoria circular and unequal in size; forty to fifty on the third joint, none on the fourth, sixteen to twenty on the fifth, the distal one the largest, and nearly all in a row;

five or six small, with one large one, at the distal end of the sixth. Eyes dark red; ocular tubercles conspicuous; ocelli present but not conspicuous. Beak dark at the distal end, lighter proximally; length, 0.54 mm., extending a little beyond the metathorax.

Thorax dark, with yellowish membranes. Wings hyaline, venation dark, frail, and normal. Stigma dark, 0.19 mm. broad; 0.99 mm. long. Total wing expansion, 8.33 mm. Tarsi, distal ends of the tibia and femora dark, remainder brownish yellow. All hirsute.

Abdomen bluish green, with about five transverse bars of black. Honey-tubes cylindrical, slightly dilated at the distal ends, concolorous with the abdomen, except the distal ends, which are dark; length, 0.54 mm., three times the length of the tarsum, and extending a little distad the style. Latter black, armed with long, spreading hairs and numerous small spines, 0.23 mm. long, or a little less than half the length of the honey-tubes. Total length of the body, 1.99 mm.

This form was taken October 25, on sycamore (*Platanus occidentalis*). It seems to be sporadic in habit, as only a few were taken, on the ventral side of the leaves. It may not be a typical representative of any species.

Macrosiphum squarrosa, n. sp. Plate XVI, fig. 84.

Head brownish black. Antennæ black, except the first, second and base of the third joints, which are brownish; length of segments: I, 0.18 mm.; II, 0.09 mm.; III, 0.75 mm.; IV, 0.79 mm.; V, 0.72 mm.; VI, 0.18 mm.; VII, 1.37 mm.; total length, 4.12 mm. The first five joints are about equal to the length of the body. Sensoria numerous, circular, and unequal in size. They are not easily detected until cleared. The approximate number is not shown in the illustration, but there are generally about thirty to fifty on the third joint, and on the fourth, twelve to fifteen; on the fifth, fifteen to twenty; and on the distal end of the sixth about six small and one large one. Eyes black; ocular tubercles prominent; ocelli present. Beak black, 0.90 mm. long, and extends a little caudad the thorax.

Thorax all black. Wings hyaline, veins black, bordered with a very faint smoky tinge. Stigma brownish black, bordered caudad with a dark band which extends to the base of the sub-

costal vein. In width the stigma is 0.14 mm., and in length 1.00 mm. Total wing expansion, 8.64 mm. Legs hirsute, black, except proximal half of the femora. All long in proportion to the body.

Abdomen brownish black. Honey-tubes black, imbricated, and 0.50 to 0.70 mm. long., being about four times the length of the tarsi. Style black, hirsute, spinous, ensiform, and 0.30 mm. long, being half the length of the honey-tubes. Total length of the body, 2.37 mm.

This form was taken October 25, on *Actinomeris squarrosa*. It is gregarious in habit and colonizes the terminal stems.

Myzus biennis, n. sp. Plate IX, fig. 51.

Head light green. Antennæ concolorous except the third, sixth, seventh and distal end of the fifth joint, which are dark. Length of segments: I, 0.12 mm.; II, 0.07 mm.; III, 0.63 mm.; IV, 0.46 mm.; V, 0.48 mm.; VI, 0.12 mm.; VII, 0.81 mm.; total length, 3.60 mm. Sensoria circular, unequal in size; about twenty on the third joint, none on the fourth, six small and one large at the distal end of the sixth. Eyes red; ocular tubercles prominent; ocelli present but not conspicuous. Beak dark at the distal end, 0.72 mm. long, extending to the metacoxæ.

Prothorax green. Thorax green. Wings subhyaline, veins dark, somewhat frail. Stigma, 0.16 mm. broad and 0.66 mm. long; total wing expansion, 6.52 mm. Legs hirsute, and concolorous except tarsi and the distal end of the tibia, which are black, normal for this genus.

Abdomen green. Honey-tube imbricated, cylindrical; concolorous except the distal end, which is dusky; length, 0.48 mm., being at least two and one-half times the length of the tarsi, extending to the apical segment of the abdomen. Style concolorous, armed with numerous small spines and some long, setaceous hairs, ensiform, 0.34 mm. long, being about twice the length of the tarsum. Total length of the body, 2.58 mm.

This form was taken May 20, on primrose (*Œnothera biennis*). It is gregarious and colonizes the terminal stems.

Macrosiphum sp.? Plate XII, fig. 70.

Head dark brown. Antennæ black, except the second joint and the base of the third; length of joints: I, 0.12 mm.; II,

0.07 mm.; III, 0.72 mm.; IV, 0.61 mm.; V, 0.54 mm.; VI, 0.14 mm.; VII, 1.00 mm.; total length, about 2.27 mm., or about one and one-half times the length of the body. Sensoria circular, about fourteen on the third joint, none on the fourth, the usual distal one on the fifth, and about six of unequal size at the distal end of the sixth. Eyes very dark red; ocular tubercles prominent; ocelli prominent and bordered with black. Beak black at the distal end and paler proximally. It extends a little beyond the mesocoxæ, being 0.54 mm. long.

Prothorax and thorax pale brown. Wings hyaline; discoidals black, costals and stigma light brown. Breadth of stigma, 0.16 mm.; length, 0.79 mm. Total wing expansion, 6.52 mm. Legs hirsute, black, blackest at the articulations; long in proportion to the body.

Abdomen brownish green. Honey-tubes black, cylindrical, imbricated, and 0.68 mm. long, being about four times the length of the tarsum. Style black, hirsute, slender, and rounded at the tip; length, 0.32 mm., being about one-half the length of the honey-tubes. Total length of the body, 1.80 mm.

This form was taken May 5, on the cultivated tomato. It is sporadic in habit and feeds on the ventral side of the leaves.

Macrosiphum pisi Kalt. Plate XV, fig. 80.

Head dark brown. Antennæ black and hirsute; length of segments: I, 0.18 mm.; II, 0.11 mm.; III, 0.99 mm.; IV, 0.81 mm.; V. 0.73 mm.; VI, 0.16 mm.; VII, 1.09 mm.; total length, 4.15 mm., extending about 1 mm. beyond the abdomen. Sensoria circular, and of various sizes; about twenty-five on the third joint, none on the fourth, the usual one present near the distal end of the fifth. At the distal end of the sixth is a cluster of about six or eight small circular sensoria, which are closely connected with a large one situated in the same place. Eyes black; ocular tubercles red. Beak brownish, becoming black at the distal end, about 0.54 mm. long, extending about half-way to the mesocoxæ.

Prothorax dark brown; thorax dark brown. Wings hyaline, venation black; stigma pale brown, 0.81 mm. long by 0.14 broad. Total wing expansion, 6.35 mm. Legs hirsute, black except the proximal part of the femora, which is light brown.

Abdomen light brown. Honey-tubes black, imbricated, cyl-

indrical, and 0.72 mm. long, or about ten times the length of the tarsi. Style hirsute, concolorous with the abdomen, 0.45 mm. long, or a little more than half the length of the honey-tubes. Total length of the body, 2.75 mm.

This form was taken from the cultivated rose, May 21. It is gregarious, and colonizes the terminal buds, leaves, and stems. This form may perhaps be called a variety of this species, since it does not correspond in every particular with the species named, yet the specimens taken, which were evidently of the same parentage, differed variously in color and size.

Macrosiphum. Plate XVIII, fig. 89.

Head dark green. Antennæ dark, except the first and second joints and the base of the third joint; length of segments: I, 0.14 mm.; II, 0.07 mm.; III, 0.84 mm.; IV, 0.72 mm., V, 0.66 mm.; VI, 0.18 mm.; VII, 0.66 mm.; total length, 3.80 mm., being the length of the seventh joint longer than the abdomen. Sensoria circular and unequal in size, fourteen to twenty on the third joint, none on the fourth, the usual distal one on the fifth, six small and one large one at the distal end of the sixth. Eyes dark red; ocelli bordered with black; ocular tubercles prominent. Beak light in color except the two distal segments, which are dark; length, 0.63 mm., extending to the mesocoxæ.

Thorax all dark green. Wings hyaline, veins dark. Stigma dark gray, 0.18 mm. broad and 0.90 mm. long. Total wing expansion, 5.60 mm. Tarsi and distal ends of the tibia and femora dark, remainder brownish yellow. All slightly hirsute.

Abdomen green. Honey-tubes dark, imbricated, cylindrical, and 0.79 mm. long, being four times the length of the tarsum. The style is hirsute and armed with short spines. It is long and slender, tapering gradually to a slender point; length, 0.36 mm., being about one-half the length of the honey-tubes. Total length of the body, 2.70 mm.

This form was taken May 17, on wild lettuce (*Lactuca scariola*). It is gregarious and colonizes the terminal stems.

Macrosiphum sp.? Plate XXI, fig. 98.

Head dark green. Antennæ black, except the first and second joints and the third, which are brownish; all slightly hirsute; length of segments: I, 0.14 mm.; II, 0.07 mm.; III, 0.73 mm.;

IV, 0.66 mm.; V, 0.61 mm.; VI, 0.16 mm.; VII, 0.97 mm.; total length, 3.08 mm.; omitting the last two segments, equal to the length of the body. Sensoria circular, unequal in size; twelve to twenty on the third joint, none on the fourth, the usual distal one on the fifth, five or six small ones bordering a larger one at the distal end of the sixth. Eyes black; ocular tubercles prominent; ocelli conspicuous, with black borders. Beak black on the distal half, remainder pale, 0.63 mm. long, extending to the mesocoxæ.

Thorax all dark green. Wings hyaline; discoidals black, costals dark brown; stigma dark, and 0.18 mm. broad by 0.81 mm. long. Total wing expansion, 7.85 mm. Legs long; the tarsi, distal part of the tibia and the femora black, remainder greenish yellow. All parts hirsute.

Abdomen greenish gray. Honey-tubes dark, imbricated, cylindrical, and 0.54 mm. long, being three times the length of the tarsum, extending nearly to the tip of the style. Style concolorous with the abdomen, slightly hirsute, long, and narrow, being two-thirds the length of the honey-tubes, or 0.36 mm. It is armed with short spines and has one characteristic long, setaceous hair located on the dorso-median line near the distal end. The style is 0.36 mm. long, or two-thirds the length of the honey-tubes. Total length of the body, 4.11 mm.

This form was taken October 23, on the ventral side of the leaf of a *Cucurbitacea* vine.

Phorodon sp. Plate XX, fig. 96.

Head black. Antennæ black and hirsute; first joint gibbous, 0.10 mm. long; II, 0.07 mm.; III, 0.50 mm.; IV, 0.27 mm.; V, 0.23 mm.; VI, 0.09 mm.; VII, 0.41 mm.; total length, 1.67 mm. The third joint has about twenty-four moderate-sized, irregularly-placed circular sensoria. The fourth joint has two or three sensoria on its basal half. The usual one is present near the distal end of the fifth joint. A cluster of about six or seven small ones are present at the union of the sixth and seventh joints. The frontal tubercles are each developed into prominent projections, which are equal in length to the front joints of the antennæ. The eyes are very dark red in color, and the ocular tubercles are small. The ocelli are not

conspicuous, but three in number. The beak is brownish and 0.27 mm. long, extending to the mesocoxæ.

The prothorax is short; the thorax is black, strongly arched, and broad. It is so much arched that the prothorax can scarcely be seen from a dorsal view. The wings are hyaline, with brownish black veins. The stigma is grayish, 0.145 mm. wide and 0.63 mm. long. A peculiar fold lies between the costal and subcostal veins of the caudal wings, which is designated in the figure. Total wing expansion, 5.80 mm. Legs are brownish black, hirsute; distal half of the femora, distal part of the tibia and all the tarsi black. Legs rather long in proportion to the body.

Abdomen is dark brown. Honey-tubes concolorous, almost cylindrical, and 0.32 mm. long, or three times the length of the tarsi. The style is black, hirsute, conical, and 0.09 mm. long, or about one-fifth the length of the honey-tubes. Total length of the body, 1.09 mm.

This form was taken in October, and since only one specimen was taken no adequate description or habit can be given. It was found in company with *Schizoneura corni*, on the ventral side of the leaves of the elm (*Ulmus americana*).